Vol. 10, No. 14
July 31, 1985

Energy Research Abstracts

Abstracts 25091-26552

Office of Scientific & Technical Information
UNITED STATES DEPARTMENT OF ENERGY

CURRENT AWARENESS PUBLICATIONS ON ENERGY

To provide complete coverage of literature related to major Department programs, announcement publications that are comprehensive in their coverage of certain energy fields are issued regularly. All information in these publications, plus additional backup information, is included in the Energy Data Base of the Office of Scientific and Technical Information; all references are also available for machine searching via the on-line retrieval system, DOE/RECON, and the commercial on-line retrieval systems. Descriptions of these current awareness publications, which are supported either directly or indirectly by the DOE, appear below. Department of Energy components may receive the listed publications free from the Office of Scientific and Technical Information, U. S. Department of Energy, P. O. Box 62, Oak Ridge, TN 37831. Telephone (615) 576-1301; FTS 626-1301.

PUBLICATIONS OF THE OFFICE OF SCIENTIFIC AND TECHNICAL INFORMATION

Energy Abstracts for Policy Analysis (EAPA)

A monthly abstract journal devoted to the analysis of energy research, conservation, and policy. Scope and coverage are limited to substantive articles or reports and emphasize legislative, regulatory, and other legal aspects, as well as social, economic, and environmental impacts. *EAPA* is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The annual subscription price is $72.00 for domestic (North America) or $90.00 for foreign (outside North America) subscribers; a single issue is $5.00 or $6.25, respectively.

Energy Research Abstracts (ERA)

A comprehensive semimonthly abstract journal devoted to all areas of energy-related information produced by the Department of Energy, other U. S. government organizations, and foreign governments. *ERA* is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The annual subscription price for the 24 issues is $146.00 for domestic (North America) subscribers or $182.50 for foreign (outside North America) subscribers. A single issue is $14.00 or $17.50, respectively.

DOE Patents Available for Licensing (PAL)

DOE is prepared to grant exclusive or nonexclusive, revocable licenses under DOE-owned U. S. patents and patent applications; this semiannual publication provides abstracting and indexing coverage of this literature. *PAL* is available on subscription (use PB85-946800) from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. The annual subscription price is $14.00 for domestic (North America) or $28.00 for foreign (outside North America); a single issue is $8.00 or $16.00, respectively.

Energy Meetings (EM)

A monthly listing of conferences, symposia, workshops, etc., pertaining to DOE's programmatic interests. *EM* is available on subscription (use PB85-901500) from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. The annual subscription price is $40.00 for domestic subscribers and $80.00 for subscribers outside the North American continent; a single issue is $5.00 and $10.00, respectively.

The following monthly update journals are available to the public on subscription from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161; use the identifying order number (PB- No.) when subscribing. The annual subscription price (12 issues plus cumulative index) is $75.00 for domestic (North America) and $150.00 for foreign (outside North America) subscribers; a single issue is $7.00 and $14.00, respectively.

***Current Energy Patents (CEP)*–PB85-902800**

Devoted to international patent literature, including patent applications, on any aspect of energy production, conservation, and utilization.

***Energy and the Environment (EAE)*–PB85-914900**

Devoted to information on the impacts of energy-related activities and radioactive and nonradioactive pollutants on the environment.

***Fossil Energy Update (FEU)*–PB85-914600**

Devoted to information on the exploration, development, processing, and use of fossil fuels.

***Fusion Energy Update (CFU)*–PB85-915300**

Devoted to information on controlled thermonuclear fusion, including plasma and fuel research and power plant engineering and conceptual design studies.

***Solar Energy Update (SEU)*–PB85-914500**

Devoted to information on the utilization of solar energy, including biomass and tidal and wind power.

The following semimonthly bulletins are also available from the National Technical Information Service. The annual subscription rate for one volume (calendar) year (24 issues; no indexes) is $40.00 for domestic (North America) and $80.00 for foreign (outside North America) subscribers; use the identifying order number (PB- No.) when subscribing.

***Acid Precipitation (APC)*–PB85-901000**

Covers all aspects of acid precipitation, including effects and possible control measures.

***Buildings Energy Conservation (BEC)*–PB85-900700**

Covers worldwide information on the technology required for energy conservation in buildings of all types.

***Coal-Based Synfuels (CBS)*–PB85-901400**

Covers all aspects of conversion of coal into gaseous or liquid fuels.

***Coal Preparation and Pollution Control (CPC)*–PB85-900800**

Covers all aspects of coal preparation and cleaning and reducing pollution from its direct combustion.

***Direct Energy Conversion (DEC)*–PB85-946600**

Covers the following areas: photovoltaics, magnetohydrodynamics, electrohydrodynamics, thermoelectrics, thermionics, and fuel cells.

***Energy from Biomass (EFB)*–PB85-900600**

Covers worldwide information on all aspects of biomass production, conversion, and utilization for energy.

***Geothermal Energy Technology (GET)*–PB85-914700**

Covers information on the exploration, development, and utilization of geothermal resources.

***Heavy-Ion Reactions (HIR)*– PB85-900500**

Covers all aspects of heavy-ion (A > 4) reactions.

***Laser Research (LAR)*–PB85-901100**

Covers all aspects of laser research and development, but excludes applications.

***Nuclear Fuel Cycle (NFC)*–PB85-913400**

Covers all aspects of the nuclear fuel cycle, both front end and back end.

***Nuclear Reactor Safety (NRS)*–PB85-913500**

Covers the safety aspects of accident analysis, safety systems, radiation protection, decommissioning and dismantling, and security measures.

***Radioactive Waste Management (RWM)*–PB85-902900**

Covers the management aspects of transport and storage, waste processing, waste disposal, waste storage, radioactive effluents, and shipping containers.

***Solar Thermal Energy Technology (STT)*–PB85-901200**

Covers research in materials, concentrators/receivers, salinity gradients, etc., for development of efficient and reliable solar thermal conversion systems.

***Unconventional Petroleum (UCP)*–PB85-901300**

Covers all aspects of secondary and tertiary recovery of petroleum and of oil shales and tar sands.

INTERNATIONAL ENERGY PUBLICATIONS

The Office of Scientific and Technical Information (OSTI) cooperates in the publication of international abstract journals with the following: (1) International Atomic Energy Agency, International Nuclear Information System, Vienna, Austria, for *Atomindex;* (2) International Energy Agency, Biomass Conversion Technical Information Service, Dublin, Ireland, for *Biomass Abstracts;* and (3) International Energy Agency, IEA Coal Research, London, England, for *Coal Abstracts.* In each case, the cognizant foreign agency provides the non-U. S. information to OSTI for inclusion in the Energy Data Base; in turn, OSTI provides the U. S. information for input into the respective journal.

Atomindex

A semimonthly abstract journal providing worldwide coverage of information on nuclear science and technology. *Atomindex* is available by subscription from UNIPUB, 345 Park Avenue South, New York, NY 10010. The cost of an annual subscription, 24 semimonthly issues and semiannual and annual cumulative indexes, is $290.

Biomass Abstracts

A bimonthly abstract journal with comprehensive coverage of information in any step involved in the eventual conversion of biomass to energy. *Biomass Abstracts* is available free to Department of Energy components and contractors from OSTI. Non-DOE organizations may obtain *Biomass Abstracts* from Biomass Conversion Technical Information Service, Institute for Industrial Research and Standards, Ballymun Road, Dublin 9, Ireland, for 42 IR pounds per year. Make checks payable to the Institute.

Coal Abstracts

A monthly abstract journal providing comprehensive worldwide coverage of information in the field of coal science and technology. *Coal Abstracts* is available to Department of Energy components and contractors from OSTI. Non-DOE organizations may obtain *Coal Abstracts* from IEA Coal Research, Technical Information Service, 14-15 Lower Grosvenor Place, London SW1W 0EX, England, for 100 pounds sterling per year.

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ENERGY RESEARCH ABSTRACTS

ABOUT THE OFFICE OF SCIENTIFIC AND TECHNICAL INFORMATION

The Office of Scientific and Technical Information (OSTI) in Oak Ridge, Tennessee, has been the national center for scientific and technical information for the Department of Energy (DOE) and its predecessor agencies since 1946. In developing and managing DOE's technical information program, OSTI places under bibliographic control not only DOE-originated information but also worldwide literature on scientific and technical advances in the energy field and announces the source and availability of this information. Whereas the literature of science is emphasized, coverage is extended to DOE programmatic, socioeconomic, environmental, legislative/regulatory, energy analysis, and policy-related areas. To accomplish this mission, OSTI builds and maintains computerized energy-information data bases and disseminates this information via computerized retrieval systems and announcement publications such as abstracting journals, bibliographies, and update journals. Direct access to OSTI's most comprehensive data base, the Energy Data Base, is available to the public through commercial on-line bibliographic retrieval systems. The Energy Data Base and many of OSTI's energy-related data bases are available to DOE offices and contractors and to other government agencies via DOE/RECON, the Department's on-line information retrieval system. The Office of Scientific and Technical Information has developed and maintains systems to record and communicate energy-related research-in-progress information, to maintain a register of DOE public communications publications, to track research report deliverables from DOE contractors, and to test and make available DOE-funded computer software programs with scientific and management applications; OSTI also serves as adviser for special publication needs of the Department. To effectively manage DOE's technical information resources, OSTI's program is one of continual development and evaluation of new information products, systems, and technologies.

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ABOUT *ENERGY RESEARCH ABSTRACTS*

Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U. S. Department of Energy, its laboratories, energy centers and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. The user should remain aware that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.

ERA is comprehensive in its subject scope, encompassing the DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

ERA is available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. Inquiries should be directed to the Office of Scientific and Technical Information, P. O. Box 62, Oak Ridge, TN 37831.

ERA is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $146.00 for domestic subscribers and $182.50 for foreign subscribers. A single issue costs $14.00 (domestic) or $17.50 (foreign). The cumulative indexes will be available in printed form from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The GPO Stock Number is 061-000-00657-5 and the price is $83.00 for the Vol. 9 indexes. The cumulative indexes are also available in microfiche form from the National Technical Information Service, U. S. Department of Commerce, Springfield, VA 22161, and from Engineered Systems, P. O. Box 866, Oak Ridge, TN 37831.

Office of Scientific and Technical Information
United States Department of Energy, P. O. Box 62, Oak Ridge, TN 37831

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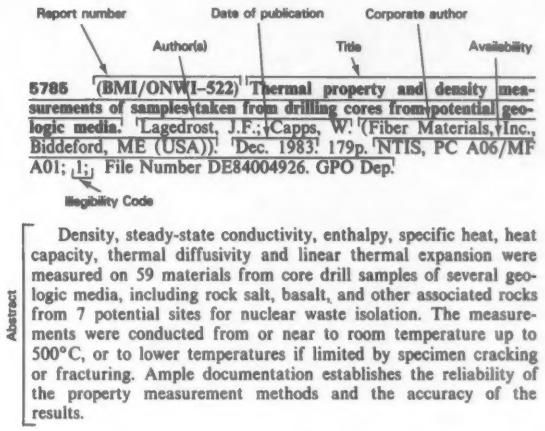
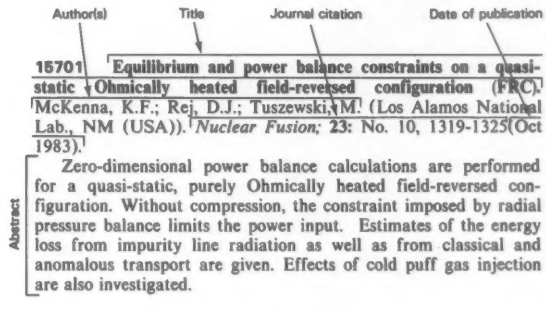
ABSTRACTS IN *ENERGY RESEARCH ABSTRACTS*

The principal elements of abstract entries for a typical research and development report and a typical technical journal article are illustrated below.


Report number
Author(s)
Date of publication
Title
Corporate author
Availability
5785 (BMI/ONWI-522) Thermal property and density measurements of samples taken from drilling cores from potential geologic media. Lagedrost, J.F.; Capps, W. (Fiber Materials, Inc., Biddeford, ME (USA)). Dec. 1983. 179p. NTIS, PC A06/MF A01; 1; File Number DE84004926. GPO Dep.
Illegibility Code
Abstract
Density, steady-state conductivity, enthalpy, specific heat, heat capacity, thermal diffusivity and linear thermal expansion were measured on 59 materials from core drill samples of several geologic media, including rock salt, basalt, and other associated rocks from 7 potential sites for nuclear waste isolation. The measurements were conducted from or near to room temperature up to 500°C, or to lower temperatures if limited by specimen cracking or fracturing. Ample documentation establishes the reliability of the property measurement methods and the accuracy of the results.


Author(s)
Title
Journal citation
Date of publication
15701 Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC). McKenna, K.F.; Rej, D.J.; Tuszewski, M. (Los Alamos National Lab., NM (USA)). Nuclear Fusion; 23: No. 10, 1319-1325 (Oct 1983).
Abstract
Zero-dimensional power balance calculations are performed for a quasi-static, purely Ohmically heated field-reversed configuration. Without compression, the constraint imposed by radial pressure balance limits the power input. Estimates of the energy loss from impurity line radiation as well as from classical and anomalous transport are given. Effects of cold puff gas injection are also investigated.

INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA)*. Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

• Corporate Author Index

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report

5785 (BMI/ONWI-522) Thermal property and density measurements of samples taken from drilling cores from potential geologic media. Lagedrost, J.F.; Capps, W. **(Fiber Materials, Inc., Biddeford, ME (USA))**. Dec. 1983. 179p. NTIS File Number DE84004926. GPO Dep.

is indexed as:

Fiber Materials, Inc., Biddeford, ME (USA)

• Personal Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

Capps, W., *See* Lagedrost, J. F.
Lagedrost, J.F., Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R;US)
McKenna, K.F., Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9:15701 (J;US)
Rej, D.J., *See* McKenna, K.F.
Tuszewski, M., *See* McKenna, K.F.

• Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

SALT DEPOSITS
Density
Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R;US)
REVERSED-FIELD PINCH
Energy Balance
Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9:15701 (J;AT)

• Contract Number Index

DOE technical report literature is indexed using contract numbers. This index contains the contract number with corresponding abstract and report numbers.

AC06-76RL01830	**Fiber Materials, Inc., Biddeford, ME (USA)**	
	9:5785	BMI/ONWI-522

• Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience. When a report is supplied under a File Number, that number is included in the availability statement. A file number–report number correlation is included for convenience.

BMI/ONWI-522	9:5785	NTIS, PC A09/MF A01. File Number DE84004926, Distribution Category MN-70

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Foreign Sources

CEA Centre d'Etudes de Saclay
GIF-sur Yvette Cedex, France

Fachinformationszentrum
Energie, Physik, Mathematik GmbH
Karlsruhe, Federal Republic of Germany

IEA Biomass Conversion Service
Dublin, Ireland

IEA Coal Research
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National Library of Medicine
Bethesda, MD

Plenum Publishing Corporation
New York, NY

University of Tennessee
Graduate School of Library and Information Sciences
Knoxville, TN

Communication concerning the editorial policy and content of *Energy Research Abstracts* should be addressed to the Editor, *Energy Research Abstracts,* Office of Scientific and Technical Information, P. O. Box 62, Oak Ridge, TN 37831.

SUBJECT CONTENTS (NUMERICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 39 first-level and 293 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semi-monthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope definitions and limitations is available as DOE/TIC-4584-R6 from NTIS for $9.50.

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REFER ALSO TO CITATION(S) 25144, 25145, 25149, 25149, 25149, 25150, 25155, 25159, 25165, 25176, 25191

25091 (CONF-850381—1) Coal conversion in aqueous systems. Ross, D.S.; Green, T.K.; Mansani, R.; Hum, G.P. (SRI International, Menlo Park, CA (USA); Western Kentucky Univ., Bowling Green (USA). Dept. of Chemistry; Assoreni, Milano (Italy)). 1985. Contract FG22-83PC60778. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010648.

From Chemistry of coal liquefaction symposium; Sapporo, Japan (17 Mar 1985).

The results, arranged in bar graph form, show a striking similarity in the product profiles of the products from Illinois No. 6 coal, independent of conversion medium and the degree of conversion. In contrast, the profile of the product of the Pittsburgh coal is substantially different, with a greater portion of the material appearing in fraction 2. This difference demonstrates that the similarities seen for the Illinois coal are a true reflection of the products and are not due merely to the analytical procedure. The observations lead to a reasonably concise model for coal conversion. It is clear that the strictly thermal component of the conversion conditions operates in two phases. The first steps involve the thermal loss of H and O, leading to an initial product (PR). The relatively slower steps following involve the conversion of the initial product to both toluene soluble (TS) fractions and char in competitive, parallel reactions. We view char production in simple operational terms as the thermally promoted loss of convertible sites in the coal. In competition with that process is the reduction chemistry involving formate, formed by the reaction of CO and OH^-. The fact that the H/C ratio of the N_2 product was similar to those for the toluene insoluble (TI) fractions suggests that the consumption of convertible sites takes place in the initial thermal product through molecular rearrangements. And finally, the similarity in liberated TS fragments over a range of conversion suggests that there may be some gross regularity within the organic matrix of coal. 7 refs., 3 figs.

25092 (CONF-8403124—Pt.1, pp 589-599) Molecular model of coal pyrolysis. Green, A.E.S.; Meyreddy, R.R.; Pamidimukkala, K.M. (Univ. of Florida, Gainesville). 1984. NTIS, PC A99/MF A01. File Number DE85009401.

From Sanibel symposia; Palm Coast, FL, USA (1 Mar 1984).

A rich body of quantitative data is available from experiments at MIT on the devolatilization of coal at various temperatures and residence times in argon and at Brookhaven on flash pyrolysis of coal at various temperatures, residence times, and pressures in several nonreactive and reactive gases. We here attempt to develop a realistic representative molecular model of coal which is compatible with proximate and ultimate analysis of coal, x-ray diffraction and other analyses of coal structures, the MIT devolatilization data, and the Brookhaven pyrolysis data. The last set gives yields of the various gases methane, ethane, and ethylene; the light liquids benzene, toluene, and xylene; and of heavy liquids or tars. We propose molecular models and a reasonable kinetics which give encouraging results in relation to these data. Our results suggest that further developments via quantum chemistry might provide a pathway to the understanding of coal pyrolysis and combustion. 33 refs., 5 figs., 2 tabs.

25093 (DOE/ET/10283—T20) Experimental program for the development of peat gasification. Final report for Project No. 65003, February 10, 1976-January 3, 1983. (Institute of Gas Technology, Chicago, IL (USA)). Jul 1983. Contract AC01-76ET10283. 30p. (FE—2469-94). NTIS, PC A03/MF A01; GPO Dep. File Number DE85010818.

The results of the program have demonstrated that, on the basis of chemistry and kinetics, peat is an excellent feedstock for the production of SNG and other gaseous and liquid fuels. Peat gasifies at a much faster rate than does lignite or other coals, and high carbon conversions can be achieved with peat at relatively low severity conditions. In hydrogasification, the product mix (gases and liquids) can be varied over a much greater range than that of lignite or other coals, to satisfy seasonally changing consumer demands. Over 200 tests were conducted in laboratory- and PDU-scale equipment with different peats to determine the effects of temperature, pressure, feedstock, feed gas composition, residence time, and other operating parameters on the gasification of peat. A mathematical model was developed that closely describes the effects of operating conditions on peat gasification. These results formed the data base for the PEATGAS process development at the pilot-plant scale. Tests with peats from different geographic locations showed the effect of feedstock source on gasification. The effect of peat dewatering methodologies (including harvesting techniques and mechanical and thermal dewatering methods) on gasification was also studied. Wet carbonization tests were conducted. Wet carbonization is a thermochemical beneficiation process that improves the heating value and dewaterability of peat. The laboratory test program was the first systemic study of the effects of wet carbonization on the carbon and oxygen conversions and heating value enhancements of peat to appear in the open literature. The PDU-test program included the design, construction, and operation of an integrated computer-controlled wet carbonization unit.

25094 (DOE/ET/10532—T22) Refining and upgrading of synfuels from coal and oil shales by advanced catalytic processes. Quarterly report, October-December 1984. Sullivan, R.F. (Chevron Research Co., Richmond, CA (USA)). Jan 1985. Contract AC22-76ET10532. 54p. (FE—2315-112). NTIS, PC A04/MF A01; GPO Dep. File Number DE85008978.

Chevron Research Company is making pilot plant tests to study the refining of process product from the Integrated Two-Stage Liquefaction (ITSL) Process. Pilot plant work is now complete; analytical work and engineering studies are now in progress. ITSL oils derived from both Illinois No. 6 and Wyodak coals were tested. Preliminary results with Wyodak oil are given here. Wyodak oils of three different end points were tested: 725°F, 775°F, and 900°F. These oils become increasingly difficult to process as the end point is increased. In all cases, however, we were able to find conditions to remove virtually all of the nitrogen - to less than 0.5 ppM. At a given feed end point, processing severities required for Wyodak and Illinois ITSL oils are about the same. 4 refs., 6 figs., 10 tabs.

25095 (DOE/MC/11955—1752, pp 1-73) Humidifier operation, Volume 1. Aug 1980. NTIS, PC A09/MF A01. File Number DE85003370.

In Modeling of wet gas cleanup - Task 13. Final technical report.

The present study addresses the physical processes essential to a basic understanding of humidifier operation. Models have been formulated to predict turbulent gas phase transport of mass, momentum, and energy, transport of particulates, and droplet evaporation/condensation. The analysis has been accomplished without undue complexity through the use of approximate integral methods,

and numerical application has been straightforward. Although insufficient experimental data exist to make a detailed investigation of predictive capability, the model is at least expected to show approximate trends associated with changes in such quantities as water flow rate, dust loading, inlet gas compositions and temperatures, and length of the chamber. Preliminary sensitivity studies indicate both kinetic and thermodynamic limitation of tar condensation under present METC operating conditions. Kinetic limitations may be alleviated through increased dust loading and/or an increase in humidifier length. Thermodynamics are made more favorable through an increase in water flow rate. The present study indicates that complete water evaporation can be achieved at flow rates substantially greater than typical METC values, provided water droplets remain in the 100μ diameter size range at inlet. Of course, nozzle performance may be degraded sufficiently at high flow rates that this condition cannot be satisfied. 11 refs., 28 figs., 2 tabs.

25096 **(DOE/MC/11955—1752, pp 74-171) Code documentation, Volume 2.** Aug 1980. NTIS, PC A09/MF A01. File Number DE85003370.

In Modeling of wet gas cleanup - Task 13. Final technical report.

This report contains general instructions for using FRCNJT, free-confined jet program, which models humidification chamber performance in the METC Wet Gas Cleanup system. The equations utilized in the code are fully described in Volume I (PSI TR-225). These instructions will familiarize the user with the input/output aspects of the code. Section II describes the basic structure of the program and the required inputs. Two forms of output are provided by the program; plots and numbers. A description of the printed output files and a general outline of the input and use of the plotting code is provided in Section III. Appendix A contains a full listing of the computer code as utilized at Physical Sciences, Inc. The program, written in FORTRAN, has been fully tested on a Prime 400 computer and results are presented in Volume I. Appendix D contains a full listing of the plotting program. This program is also written in FORTRAN, however, the plotting subroutines are machine dependent. These routines are similar to Calcomp plotting subroutines, and a few modifications may well be needed to make the program operational on computers other than Prime.

25097 **(DOE/MC/11955—1752) Modeling of wet gas cleanup - Task 13. Final technical report.** Wolf, T.L.; Finson, M.L.; Piper, L.G.; Simons, G.A.; Cronin, J.F. (Physical Sciences, Inc., Woburn, MA (USA)). Aug 1980. Contract AT21-79MC11955. 178p. NTIS, PC A09/MF A01; GPO Dep. File Number DE85003370.

This report contains two volumes bound together. Volume 1 is titled "Humidifier Operation" and Volume 2 is "Code Documentation". A separate abstract was prepared for each volume.

25098 **(DOE/MC/16512—1619) Coal slurry letdown valve-concept test phase. Final report.** Collins, E.R. Jr.; Suitor, J.W. (Jet Propulsion Lab., Pasadena, CA (USA)). Jan 1984. Contract AI21-81MC16512. 135p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE84009253.

The results of the concept test phase of a novel pressure letdown device indicate usefulness of the concept. The device, using staged letdown, was designed to minimize erosion damage by minimizing slurry velocities through the pressure restrictions. Tests were performed on air, steam/water and a coal slurry with a flashing component. Two valve sizes were used. Based on the results of these tests, the following conclusions were drawn: (1) the basic operating principle of designing for a constant velocity through the orifice restrictions is correct; (2) multiphase pressure letdown can be modeled; (3) temperature profiles are predictable; and (4) erosion in three-phase flow is a complex phenomenon. Recommendations for further work on the device include: (1) development of a controllable device; (2) correlation of further test data; and (3) study of flow regimes where erosion is minimized. 9 refs., 48 figs., 6 tabs.

25099 **(DOE/MC/19077—1830) Development of a hot gas cleanup system for integrated coal gasification/molten carbonate fuel cell power plants. Final report.** Lyke, S.E.; Sealock, L.J. Jr.; Roberts, G.L. (Pacific Northwest Labs., Richland, WA (USA)). Jan 1985. Contract AC21-82MC19077. 176p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE85009691.

Battelle, Pacific Northwest Laboratories has developed a solid supported molten salt (SSMS) hot gas cleanup process for integrated coal gasification/molten carbonate fuel cell (MCFC) power plants. In bench scale experiments the process simultaneously removed hydrogen sulfide (H_2S), carbonyl sulfide (COS) and hydrogen chloride (HCl) from MCFC anode feed gas at 1375 to 1475°F and up to 180 psig. Regeneration produced a H_2S-rich gas from which elemental sulfur could be efficiently recovered. Through 16 absorption/regeneration cycles at each of two absorber sizes, conditions for continuous removal of H_2S to less than 1 ppM were well established. Further study would be required to assure removal of COS and HCl to that degree in a commercial design and to develop a practical means for chloride regeneration. A dynamic model was developed that uses measured equilibium data and the two film theory to represent mass transfer resistance. The model can accurately simulate absorption and early regeneration performance under a range of conditions using a single, overall particle phase mass transfer coefficient. A 50% reduction in cost of the SSMS system would make the cost of coal gasification/SSMS/MCFC power plants competitive with published estimates for other developmental technology. Effective sulfur capacity and, therefore, economics, improve with more reducing, lower pressure and higher temperature absorption conditions. Battelle proposes avenues for process and sorbent optimization that would further improve efficiency and could also produce the required cost reduction. Further study is recommended to allow comparison of SSMS with other hot gas cleanup and sulfur recovery systems on an equivalent basis and to determine whether further development of the solid supported molten carbonate concept for the MCFC application is justified. 35 figs.

25100 **(DOE/MC/19122—1821) Advanced development of a pressurized ash agglomerating fluidized-bed coal gasification system. Third quarter progress report FY-1983, April 1-June 30, 1983.** (Westinghouse Electric Corp., Madison, PA (USA). Synthetic Fuels Div.). 7 Sep 1983. Contract AC21-82MC19122. 102p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85011297.

The overall objective of the Westinghouse coal gasification program is to demonstrate the viability of the Westinghouse pressurized, fluidized bed, gasification system for the production of medium-Btu fuel gas for syngas, electrical power generation, chemical feedstocks, or industrial fuels and to obtain performance and scaleup data for the process and hardware. Accomplishments for the past quarter are presented for the following tasks: process development unit test operations; process analysis; process and component engineering and design; cold flow scaleup facility; and laboratory support studies. 3 refs., 33 figs., 11 tabs.

25101 **(DOE/MC/19210—1819) Computed tomography of coals. Quarterly technical progress report No. 5, September 30, 1983-January 1, 1984.** Maylotte, D.H.; Kosky, P.G.; Spiro, C.L.; Lamby, E.J.; Black, S.H. (General Electric Co., Schenectady, NY (USA). Corporate Research and Development Center). 1984. Contract AC21-82MC19210. 74p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85011791.

A pyrolysis apparatus has been constructed to fit inside the aperture of an x-ray computed tomography (CT) machine. With this equipment the density variations inside pieces of Illinois No. 6 coal have been followed as a function of time. When the sudden temperature rise experienced by, for example, the coal feed to a fixed or fluidized bed gasifier was simulated, then the pyrolysis front penetrated into the coal as a very narrow band 1 to 2 mm wide. The speed of the pyrolysis front can be observed by the CT equipment and also the extent of material loss upon pyrolysis. Very little of the coal is molten at any one time. Two-dimensional finite element analysis of the motion of the pyrolysis front provides time

dependent temperature profiles within the coal which can be compared with the CT results. Effective thermal conductivities 2 to 3 times slower than published values will probably be necessary to bring agreement. Pyrolysis gases appear to be escaping via cracks to the outside rather than by diffusion through the coke. From quite early stages the pyrolysis front obeys the (d^2) law commonly found in experiments on burning fuel droplets. This observation may enable an analytical solution for the propagation of the pyrolysis front to be formulated. Further experiments using high water content coals (e.g., lignite) are being planned, as well as extensions from pyrolysis to gasification with CO_2 and steam. 4 refs., 62 figs., 2 tabs.

25102 **(DOE/MC/19314—6) Differential optical absorption techniques for diagnostics of coal gasification. Technical progress report, January-March 1984.** (Mississippi State Univ., Mississippi State (USA). MHD Energy Center). Aug 1984. Contract AC21-82MC19314. 24p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010177.

The application of differential optical absorption (DOA) techniques for the in-situ determination of the chemical composition of coal gasification process streams is investigated. Absorption spectra of relevant molecular species and the temperature and pressure effects on DOA-determined spectral characteristics of these species will be determined and cataloged. A system will be configured, assembled, and tested.

25103 **(DOE/MC/21225—8) Wet carbonization of lump-size low-rank coals by a novel non-slurry approach. Progress report, November 1984-January 1985.** Lau, F.S.; Roberts, M.J.; Mensinger, M.C.; Rue, D.M. (Institute of Gas Technology, Chicago, IL (USA)). Apr 1985. Contract AC21-84MC21225. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85008979.

The design of the wet-carbonization process research unit (PRU) continued during the current quarter. The PRU is designed to handle about 100 lb/h of as-received coal. The main reactor will be able to operate at a maximum temperature of 650°F and a pressure of 2300 psig. Process flow and instrument diagrams for the system were completed. Equipment purchased during this quarter included the high-pressure feed and discharge screws, five pressure vessels and three pumps. Structural, electrical, and process control and data acquisition instrumentation bid packages have been prepared. Nine batch wet-carbonization tests were conducted during this quarter. Three coals were tested: two from North Dakota (lignites from Mercer and Oliver counties) and one from Montana (Rosebud subbituminous). The operating conditions of the tests covered a temperature range of 400° to 650°F and a residence time range of 0 to 60 minutes. Preliminary results indicated that heating value enhancements of about 17% (ash-free basis) were achieved with Indian Head lignite wet carbonized at 650°F for 60 minutes. A fourth coal, from the South Hallsville mine near Martin Lake, Texas, will be tested. Two tons of this Texas lignite are scheduled to be delivered in February. Tests to determine the weathering characteristics of these beneficiated coals are also being conducted. These include drop-shatter tests, equilibrium moisture content determinations, bulk and particle density measurements, and particle shrinkage determinations. Preliminary results indicate that increasing the wet-carbonization temperature from 400° to 550°F decreased the equilibrium moisture content of the Indian head lignite from about 26 to 17 wt %. Liquid samples from these tests were collected for bioassay tests. 11 figs., 4 tabs.

25104 **(DOE/METC—85/2002) Slurry test report: Fairchild Controls System's Type III prototype lockhopper valve, METC prototype test valve No. F-4.** Ayers, W.J.; Wojewodka, R.A. (USDOE Morgantown Energy Technology Center, WV). Jan 1984. 32p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85001977.

METC Test Valve No. F-4 was an 8-inch segmented ball or visor valve design developed and manufactured by Fairchild Controls System under contract to the Department of Energy. The valve completed slurry testing, accumulating a total of 3191 valve cycles of which 2625 cycles were with material transfer. However, several internal leak rate measurements exceeded the METC failure criteria. Post test inspection revealed damage to the seats. Results of testing showed that internal leakage increased as test pressure increased and was affected by cycling pressure. A cycling pressure of 800 psig resulted in a higher internal leakage than a 1600 psig cycling pressure. In addition, the variability associated with measuring internal leakage also increased as test pressure increased. 5 refs., 10 figs., 1 tab.

25105 **(DOE/METC—85/2003) Commercial feasibility of underground gasification of Texas lignite to produce synthetic gas.** Bartke, T.C.; Tucker, W.F.; Smith, R.S.; Glatzer, B.H. (Republic of Texas Coal Co., Houston (USA)). Feb 1985. Contract FG01-80RA50380. 72p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85001998.

As part of the US Department of Energy's (DOE) Underground Coal Conversion (UCC) program, the Republic of Texas Coal Company conducted engineering, geologic, and financial studies to determine the commercial feasibility of developing deep basin Texas lignite. The lignite would be developed by in situ gasification to produce a synthesis gas consisting of hydrogen and carbon dioxide. The study was conducted during a 2-year period from October 1, 1980 to December 31, 1982. The study was designed to analyze the four major factors that determine commercial feasibility of industrial processes: (1) market potential, (2) finance, (3) site selection and characterization, and (4) process and facility design engineering. The results of the study indicated that such a facility was both technically and economically feasible if appropriate financing could be found. A preferred site meeting the geologic, technical, and environmental parameters for an efficient in situ gasification facility was selected in east Texas in Panola County, 5 miles west of Carthage, Texas. It was also discovered that the Carthage site was in the proximity of a number of oil reservoirs that were suitable for EOR by CO_2 flooding. The engineering and design analysis, which included an in situ field and a surface cleanup and purification facility, incorporated system design descriptions for nine major project systems: (1) underground coal gasification (by reverse combustion linkage), (2) underground coal gasification (by directional drilling), (3) air separation system, (4) sulfur recovery system, (5) CO-shift system, (6) acid gas removal system, (7) raw gas cooling and scrubbing system, (8) gas compression system, and (9) methanol synthesis system. Directional drilling was determined to be the optimal method for in situ gasification in the field. 23 figs., 15 tabs.

25106 **(DOE/PC/30027—60) Recycle slurry oil characterization. Technical report, October 1983-March 1984.** Burke, F.P.; Winschel, R.A.; Robbins, G.A. (Conoco, Inc., Library, PA (USA). Coal Research Div.). Mar 1985. Contract AC22-80PC30027. 162p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85011960.

Run 3LCF10 was the first Lummus Integrated Two-Stage Liquefaction (ITSL) operation with subbituminous coal. It was of interest, therefore, to determine the effect of coal type on process oil characteristics. Previous work with H-Coal recycle oil samples had shown significant differences between Illinois 6 and Wyodak coals. In particular, the subbituminous coal produced recycle oils much richer in paraffinic components than the bituminous coal. These were poorer hydrogen donor media than the bituminous coal derived solvents, and solvents of this quality could have posed serious problems in ITSL in achieving adequate coal conversion in the short contact time (SCT) first-stage reactor. The results of Run 3LCF10 showed much less difference between the Wyodak and Illinois 6 coal-derived process oils. Conoco received and analyzed a total of 162 feed and product samples. These materials were characterized in terms of parameters reflecting their molecular compositions and by standard empirical tests. The results were used to describe the subject ITSL operations in terms of process oil compositions, and to relate those compositions to such measures of process performance as catalyst activity and product yields. Conversions, yields and kinetic parameters were calculated for 3LCF10. Overall $850°F^+$ conversions and kinetic constants agree well with Lummus' reported results, and show the facile convertability of Wyodak SCT product. Because the Wyodak coal-derived resid is more easily converted, Run 3LCF10 was made at lower temperature than the bituminous coal runs. This could account for the less rapid apparent catalyst deactivation. Appendices 2 and 3 have been entered individually into EDB and ERA. 12 refs., 13 figs., 40 tabs.

25107 (DOE/PC/30027—61) Recycle slurry oil characterization. Final report, October 1980-March 1985. Burke, F.P.; Winschel, R.A.; Robbins, G.A. (Conoco, Inc., Library, PA (USA). Coal Research Div.). Mar 1985. Contract AC22-80PC30027. 131p. NTIS, PC A07/MF A01; GPO Dep. File Number DE85011961.

This report includes results and interpretation of Conoco's analyses of process oils from Wilsonville Run 246 operated from April through August, 1984, in the DITSL and ITSL modes with Clovis Point subbituminous coal. Seventy-one samples were analyzed from Run 246. Characterization and interpretation of eight samples from HRI CTSL Run 227-18 (a scoping run) and twenty-five samples from HRI CTSL Run 227-20 (a demonstration run) are presented. Results are given from analysis of eleven distillate and eleven resid samples from Lummus Run 4LCF14 which tested the effects of LC-Finer conditions on recycle solvent quality. The molecular composition of a typical Lummus ITSL recycle distillate is presented. The reproducibility of several of our routine analytical and empirical methods is demonstrated. 15 refs., 17 figs., 45 tabs.

25108 (DOE/PC/40785—12) Exploratory study of coal conversion chemistry. Final report, May 18, 1981-May 17, 1984. Ross, D.S.; McMillen, D.F.; Chang, S.J.; Hum, G.P.; Green, T.K.; Malhotra, R. (SRI International, Menlo Park, CA (USA)). Dec 1984. Contract AC22-81PC40785. 120p. NTIS, PC A06/MF A01; GPO Dep. File Number DE85010393.

Studies with model compounds demonstrated that very strong bonds can be broken under donor solvent liquefaction conditions. Therefore, the liquefaction of coals under these conditions does not have to be, as traditionally held, dependent on the thermal scission of inherently weak links in the coal structure. These studies also showed that the actual conversions of coal reported by a number of workers show a dependence on donor solvent C-H bond strength that is not in accord with the traditional mechanism, in which the donor solvent operates solely as a scavenger or "capper" of thermally generated coal radicals. We have shown that the coal liquefaction effectiveness of various solvents parallels much more closely the observed cleavage of these strong linkages in donor solvent. Therefore, we have suggested that this type of cleavage reaction, which we have labeled "solvent mediated hydrogenolysis," is responsible for the bulk of coal structure fragmentation during donor solvent coal liquefaction. The class of linkages susceptible to the type of cleavage addressed here is very large and almost certainly dominant in coals, no matter what the exact details of their structures turn out to be. For this class of linkage, the results presented here show that cleavage results from the direct bimolecular transfer of hydrogen from hydroaromatic solvent radicals, ArH(dot), to the ipso position of the Ar-X linkage. This sequence is formally hydrogenolysis, but it takes place without the intervention of free hydrogen atoms and therefore without the conditions of high hydrogen pressure and high temperature and/or catalysts that are generally required to provide free H-atoms.

25109 (DOE/PC/50030—T1) Fluid seals development for coal liquefaction slurry pumps. Quarterly technical progress report No. 7, April 1-June 30, 1984. Burcham, R.E. (Rockwell International Corp., Canoga Park, CA (USA). Rocketdyne Div.). 19 Jul 1984. Contract AC22-82PC50030. 22p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85006532.

This quarterly progress report covers the work performed during the period April 1, 1984 to June 30, 1984 on the Fluid Seals Development for Coal Liquefaction Slurry Pumps Program. The work was sponsored by the Department of Energy, Pittsburgh Technology Center, to develop technology for hydrostatic fluid seals to be used in coal slurry centrifugal and reciprocating pumps. The scope of the program consists of the following tasks: (1) Task 1A, survey of current practices for centrifugal and reciprocating coal slurry pump seals; (2) Task 1B, preliminary evaluation of three alternative centrifugal and reciprocating fluid seal concepts; (3) Task 2, detail evaluation of the best two centrifugal and reciprocating fluid seal concepts; (4) Task 3A, design and fabrication of the selected centrifugal and reciprocating fluid seal concept, design and fabrication of the centrifugal and reciprocating seal testers; (5) Task 3B, laboratory seal testing of the centrifugal and reciprocating fluid seals; (6) Task 4, field testing of the centrifugal and reciprocating fluid seals. Tasks 1, 2, and 3A have been completed. Task 3B is in progress. Task 4 is pending Department of Energy direction. 2 figs., 3 tabs.

25110 (DOE/PC/50030—T2) Fluid seals development for coal liquefaction slurry pumps. Quarterly technical progress report No. 6, 1 January-31 March 1984. Burcham, R.E. (Rockwell International Corp., Canoga Park, CA (USA). Rocketdyne Div.). 23 Apr 1984. Contract AC22-82PC50030. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85006530.

The purpose is to develop technology for hydrostatic fluid seals to be used in coal slurry centrifugal and reciprocating pumps. The scope of the program consists of the following tasks: (1) Task 1A, survey of current practices for centrifugal and reciprocating coal slurry pump seals; (2) Task 1B, preliminary evaluation of three alternative centrifugal and reciprocating fluid seal concepts; (3) Task 2, detail evaluation of the best two centrifugal and reciprocating fluid seal concepts; (4) Task 3A, design and fabrication of the selected centrifugal and reciprocating fluid seal concept, design and fabrication of the centrifugal and reciprocating seal testers; (5) Task 3B, laboratory seal testing of the centrifugal and reciprocating fluid seals; (6) Task 4, field testing of the centrifugal and reciprocating fluid seals. Tasks 1 and 2 have been completed. Tasks 3A and 3B are in progress. Task 4 is pending Department of Energy direction. 1 fig.

25111 (DOE/PC/50030—T3) Fluid seals development for coal liquefaction slurry pumps. Quarterly technical progress report No. 8, 1 July-30 September 1984. Burcham, R.E. (Rockwell International Corp., Canoga Park, CA (USA). Rocketdyne Div.). 24 Oct 1984. Contract AC22-82PC50030. 21p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85006531.

This quarterly progress report covers the work performed during the period 1 July 1984 to 30 September 1984 on the Fluid Seals Development for Coal Liquefaction Slurry Pumps Program. The work was sponsored by the Department of Energy, Pittsburgh Technology Center, to develop technology for hydrostatic fluid seals to be used in coal slurry centrifugal and reciprocating pumps. The scope of the program consists of the following tasks: (1) Task 1A, survey of current practices for centrifugal and reciprocating coal slurry pump seals; (2) Task 1B, preliminary evaluation of three alternative centrifugal and reciprocating fluid seal concepts; (3) Task 2, detail evaluation of the best two centrifugal and reciprocating fluid seal concepts; (4) Task 3A, design and fabrication of the selected centrifugal and reciprocating fluid seal concept, design and fabrication of the centrifugal and reciprocating seal testers; (5) Task 3B, laboratory seal testing of the centrifugal and reciprocating fluid seals; (6) Task 4, field testing of the centrifugal and reciprocating fluid seals. Tasks 1, 2, and 3A have been completed. Task 3B is in progress. Task 4 is pending Department of Energy direction. 1 fig., 2 tabs.

25112 (DOE/PC/50030—T4) Fluid seals development for coal liquefaction slurry pumps. Quarterly technical progress report No. 9, October 1-December 31, 1984. Burcham, R.E. (Rockwell International Corp., Canoga Park, CA (USA). Rocketdyne Div.). 24 Jan 1985. Contract AC22-82PC50030. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85007180.

This quarterly progress report covers the work performed during the period October 1-December 31, 1984 on the Fluid Seals Development for Coal Liquefaction Slurry Pumps Program. The work was sponsored by the Department of Energy, Pittsburgh Technology Center, to develop technology for hydrostatic fluid seals to be used in coal slurry centrifugal and reciprocating pumps. The scope of the program consists of the following tasks: (1) Task 1A, survey of current practices for centrifugal and reciprocating coal slurry pump seals; (2) Task 1B, preliminary evaluation of three alternative centrifugal and reciprocating fluid seal concepts; (3) Task 2, detail evaluation of the best two centrifugal and reciprocating fluid seal concepts; (4) Task 3A, design and fabrication of the selected centrigfugal and reciprocating fluid seal concept, design

and fabrication of the centrifugal and reciprocating seal testers; (5) Task 3B, laboratory seal testing of the centrifugal and reciprocating fluid seals; (6) Task 4, field testing of the centrifugal and reciprocating fluid seals. Tasks 1, 2, 3A, and 3B have been completed. Task 4 is pending Department of Energy approval. 1 fig., 3 tabs.

25113 **(DOE/PC/50030—T6) Fluid seals development for coal liquefaction slurry pumps. Quarterly technical progress report No. 2, 1 January-31 March 1983.** Burcham, R.E. (Rockwell International Corp., Canoga Park, CA (USA). Rocketdyne Div.). 19 Apr 1983. Contract AC22-82PC50030. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85009728.

A detailed evaluation of the best two centrifugal and reciprocating fluid seal concepts selected in the Task 1 preliminary evaluation was performed. The seal concepts were: (1) hydrostatic orifice compensated pocket floating bushing and (2) hydrostatic tapered bore floating ring. Two different arrangements of the tapered bore floating ring seals for each pump were evaluated. The results indicate that the tapered bore floating ring fluid seals with standard seals on the outboard end have significantly lower total flush fluid leakage than the other concepts for both the centrifugal and reciprocating pump. The slurry side leakage rate is within the three percent of pump flow design goal. The hydrostatic pocket bushing fluid seal slurry side leakage is satisfactory on the centrifugal pump, but exceeds the design goal on the reciprocating pump discharge stroke. The tapered bore floating ring fluid seal concept is recommended for Task 3 due to lower total flush fluid leakage, more practical design, lower initial cost and lower maintenance cost. 20 figs., 2 tabs.

25114 **(DOE/PC/50030—T7) Fluid seals development for coal liquefaction slurry pumps. Quarterly technical progress report No. 3, 1 April 1983-30 June 1983.** Burcham, R.E. (Rockwell International Corp., Canoga Park, CA (USA). Rocketdyne Div.). 27 Jul 1983. Contract AC22-82PC50030. 20p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85009729.

A survey of current practices for centrifugal and reciprocating coal slurry pump seals and a preliminary evaluation of three alternative centrifugal and reciprocating fluid seal concepts was performed in Task 1. The detail technical results were reported in the interim technical report for Task 1 (TPME 3172-6729). The Task 2 detail evaluation was completed and the detail technical results were reported in the interim technical report for Task 2 (TPME 3172-6835). The results indicate that the tapered bore floating ring seal is the best concept. The Task 3 design and fabrication was initiated. The seal detail drawings were released and procurement was initiated. The tester design requirements were established, and it was determined that standard pumps can be utilized for both the centrifugal and reciprocating seal testers. 8 figs., 1 tab.

25115 **(DOE/PC/50030—T8) Fluid seals development for coal liquefaction slurry pumps. Quarterly technical progress report No. 4, 1 July 1983-30 September 1983.** Burcham, R.E. (Rockwell International Corp., Canoga Park, CA (USA). Rocketdyne Div.). 21 Oct 1983. Contract AC22-82PC50030. 33p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85009730.

The scope of the program consists of the following tasks: (1) Task 1A, survey of current practices for centrifugal and reciprocating coal slurry pump seals; (2) Task 1B, preliminary evaluation of three alternative centrifugal and reciprocating fluid seal concepts; (3) Task 2, detail evaluation of the best two centrifugal and reciprocating fluid seal concepts; (4) Task 3A, design and fabrication of the selected centrifugal and reciprocating fluid seal concept. Design and fabrication of the centrifugal and reciprocating seal testers; (5) Task 3B, laboratory seal testing of the centrifugal and reciprocating fluid seals; (6) Task 4, field testing of the centrifugal and reciprocating fluid seals. Tasks 1 and 2 have been completed. The technical results were reported in the interim technical reports. Task 3A is in process. Design of the selected fluid seal concepts and the design requirements to modify field type pumps for the seal testers was completed during the previous period. 12 figs., 9 tabs.

25116 **(DOE/PC/50030—T10) Fluid seals development for coal liquefaction slurry pumps. Quarterly technical progress report No. 10, 1 January 1985-31 March 1985.** Burcham, R.E. (Rockwell International Corp., Canoga Park, CA (USA). Rocketdyne Div.). 22 Apr 1985. Contract AC22-82PC50030. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010430.

This quarterly progress report covers the work performed during the period January 1, 1985 to March 31, 1985 on the Fluid Seals Development for Coal Liquefaction Slurry Pumps Program. The work was sponsored by the Department of Energy, Pittsburgh Technology Center, to develop technology for hydrostatic fluid seals to be used in coal slurry centrifugal and reciprocating pumps. The scope of the program consists of the following tasks: (1) Task 1A, survey of current practices for centrifugal and reciprocating coal slurry pump seals; (2) Task 1B, preliminary evaluation of three alternative centrifugal and reciprocating fluid seal concepts; (3) Task 2, detail evaluation of the best two centrifugal and reciprocating fluid seal concepts; (4) Task 3A, design and fabrication of the selected centrifugal and reciprocating fluid seal concept, design and fabrication of the centrifugal and reciprocating seal testers; (5) Task 3B, laboratory seal testing of the centrifugal and reciprocating fluid seals; (6) Task 4, field testing of the centrifugal and reciprocating fluid seals. Tasks 1, 2, 3A, and 3B have been completed. Task 4 is pending Department of Energy approval. 2 figs., 1 tab.

25117 **(DOE/PC/50800—T10) Transport and relaxation processes in supercritical fluids. Technical progress report, January 1-March 31, 1985.** Jonas, J. (Illinois Univ., Urbana (USA). Dept. of Chemistry). 1985. Contract FG22-82PC50800. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010554.

In this quarter we have ompleted our study of naphthalene solubilities in supercritical carbon dioxide. Our unique, insitu NMR method had been used to obtain solubility data for this system at 50.0, 55.0 and 58.5°C in the pressure range of 120 to 500 bar. Although this system had been previously investigated (Paulaitis, et al., J. Chem. Eng. Data, Vol. 25(4), 1980), we have better defined the solubilities near the upper critical end point of the binary mixture. And finally, we have completed our determination of the three phase solid-liquid-vapor curve of the system. The mixing probe performed very well during its first run in March. The successful outcome of this test shows the utility of stirring reaction mixtures in the probe; application to supercritical fluid studies can be expected to show similar dramatic increases in the rate at which equilibrium conditions are reached in the coil region. 2 figs.

25118 **(DOE/PC/60778—6) Chain hydrogenolysis and hydrogen atoms in coal conversion. Quarterly report No. 6, December 1, 1984-February 28, 1985.** Ross, D.S.; Hum, G.; Miin, T.C. (SRI International, Menlo Park, CA (USA)). Apr 1985. Contract FG22-83PC60778. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85011299.

Previous studies of coal liquefaction under supercritical conditions led to the conclusion that char formation competes with liquefaction reactions. That is, the reactive sites on coal can follow parallel liquefaction and char formation reactions yielding TS (Toluene solubles) and TI (Toluene insolubles). The production of TS is due to the reducing potential in the reaction system, while the TI yield is due to heat-induced polymerization. The present program is being conducted to improve our understanding of this process. The work centers around thermal pretreatment of the coal. Coal is first pretreated in N_2/H_2O and then converted under the conventional reducing reactions (CO/H_2O). If thermal polymerization is substantially slower than the reducing reactions, decreasing toluene solubilities will be obtained when the time of thermal polymerization is increased. To avoid the problem of 45- to 60-minute heat-up periods in our conventional 300 ml autoclave, some of the studies were conducted in 24-ml microreactor. The effects of the thermal pretreatment that bring about increased convertibility of the coal are not understood at present. We have found in past work that 0-loss from bituminous coal under conversion conditions is rapid, and takes place whether or not conversion occurs. It is reasonable to suggest that the two phenomena are linked in some way. The rates of heating also may be important in the production of TS products.

This suggestion is supported by the data obtained from the low-temperature pretreatment runs. In the microreactor, the run without pretreatment gave only 23% TS solubles, while 44% was attained when the coal was pretreated at 150°C. This finding confirms our previous proposal that an intermediate exists before TS is formed. That is, coal is converted to this intermediate, which can then be converted to TS and char. 3 figs.

25119 **(DOE/PC/60783—T1) Study of the kinetics of hydrogenation using aged catalysts. Quarterly technical progress report, 1 October 1984-31 December 1984.** Schweighardt, F.K. (Air Products and Chemicals, Inc., Allentown, PA (USA)). Mar 1985. Contract FG22-83PC60783. 17p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010427.

Preliminary testing of catalyst samples has been completed. The results show that catalyst samples that have not experienced a large (>3 wt %) coke deposit buildup do not show a large change in pyrene conversion at 13 and 90 minutes at 350°C. Catalyst samples that are well aged (e.g., 505 lb SRC/lb catalyst) show a significant change in pyrene conversion in relationship to the particle size of the catalyst. Oxidation of the catalyst to remove carbon deposits is affective, but does not restore complete (>90%) activity to the catalyst. These observations were reproduced on our system to prepare the groundwork for conducting the catalytic conversion of polynuclear aromatics with 25 to 50 g of whole catalyst pellets and comparing the results to those of the ground (100 mesh) catalyst. 21 refs.

25120 **(DOE/PC/60787—6) Composite-bed reactor for upgrading coal-derived liquids. Quarterly report No. 6, January 1-March 31, 1985.** Crynes, B.L.; Seapan, M. (Oklahoma State Univ., Stillwater (USA). School of Chemical Engineering). 17 Apr 1985. Contract FG22-83PC60787. 14p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85009738.

Three experimental runs were completed on the catalyst zone study at conditions of 400°C (752°F), LHST of 1.9 h, 10.3 MPa (1500 psig), with equal amounts of catalysts in the top and bottom zones and processing a 10% SRC in process solvent. All three runs contained a commercial Ni-Mo catalyst in the bottom zone but the top zones contained, respectively, Co-Mo, Ni-W, and Ni-Mo commercial catalysts. These runs are part of a six experimental run set involving various combinations of catalyst types in the two reactor zones. Some of the liquid product and spent catalyst analyses have been completed. These three experimental runs showed a lower initial nitrogen removal than for the two experimental runs, CZA and CZB, reported in the last quarterly (40 to 55% removal versus 55 to 90% removal). Those runs with the higher percent removal contained Ni-Mo catalysts in both zones. The results on hydrogen-to-carbon atom ratios show little differentiation between any of the catalyst combinations investigated thus far. Loss in catalyst surface area and pore volume occurs in the top zone to a greater extent than in the lower zone. Furthermore, each zone itself has a gradient from top to bottom. 3 figs., 5 tabs.

25121 **(DOE/PC/60798—6) Catalytic hydrotreatment studies with model compounds. Quarterly report, January 1-March 31, 1985.** Satterfield, C.N.; Smith, C.M.; LaVopa, V. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Chemical Engineering). 1985. Contract FG22-83PC60798. 21p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010187.

In catalytic hydrotreatment reactors the ratio of vapor to liquid flow rate can affect the distribution of reactants and reactant intermediates between the two phases. This is, of course, also affected by pressure and temperature. Laboratory work with model compounds may be done in vapor-phase reactors, in trickle-bed reactors or in completely liquid-phase systems presaturated with hydrogen. There seems to be little information on how the kinetics of a model reaction may change as the phase is changed or as the ratio of the two phases is changed. Our studies this quarter involved some exploratory work to see how significant these effects might be, using the hydrodenitrogenation of quinoline as a model reaction, in either (1) a vapor-phase system in which it is fed as a solution in a C_{16} hydrocarbon or (2) a vapor-liquid system in which it is fed as a solution in a C_{18}-C_{36} white oil. The studies thus far indicate that for a given initial quinoline partial pressure and a given residence time, the percent HDN and the concentrations of intermediate species are all essentially independent of whether or not an inert liquid phase is present. However effective reaction order or quinoline HDN is greater than zero so that the reaction rate will reflect differences in the vapor-liquid equilibrium. Futhermore the exposure of the catalyst to H_2S is governed solely by its vapor-phase partial pressure. 14 figs.

25122 **(DOE/PC/60800—5) Active sites in char gasification. Quarterly technical progress report, 1 October-31 December 1984.** Calo, J.M.; Suuberg, E.M.; Lilly, W.; Hradel, G.; Wojtowicz, M. (Brown Univ., Providence, RI (USA). Div. of Engineering). 1985. Contract FG22-83PC60800. 20p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85009863.

This project is concerned with the study of the nature and behavior of active sites in the gasification of chars produced from synthesized model compounds, primarily those of the phenol-formaldehyde family of resins. One of the tasks defined for this project is to conduct transient kinetic studies on the gasification of these model compound chars. A new jet-stirred, pyro-gasifier reactor had to be developed for this purpose. Preliminary design considerations and calculations for this reactor were presented in a previous quarterly report (DOE/PC60800-2). Since that report, the reactor has been constructed and has undergone some preliminary testing. The current quarterly technical progress report summarizes the work to date on this reactor. 8 refs., 2 figs., 1 tab.

25123 **(DOE/PC/70801—T2) Thermodynamic properties for supercritical coal conversion. Quarterly progress report, December 10, 1984-March 20, 1985.** Eckert, C.A. (Illinois Univ., Urbana (USA). Dept. of Chemical Engineering). 1985. Contract FG22-84PC70801. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85009298.

We have measured solubilities for several model coal compounds in supercritical CO_2 containing small amounts of methanol as an entrainer. Solubilities have been measured for such compounds as dibenzofuran, fluorenone, acridine and phenanthene with varying amounts of the methanol. Depending upon the nature of the functional groups within the solute molecule, the solubilities have shown moderate to large indreases over the solubility in pure CO_2. The degree of increase can be related to the amount of chemical interaction between the functional group on the entrainer and the functional groups on the solute. The use of an entrainer shows promise by also increasing the selectivity of a supercritical fluid extraction. Preliminary modelling of these doped systems has been done using the Peng Robinson (PR) equation but much more work is required in interpreting results. Correlating solubility data for the moderate temperature fluids has shown that with equal number of parameters, the cubic equation of state performs as well as the more sophisticated perturbed hard sphere equations. There are differences in regions of applicability and qualitative behavior, but numerical quality is very similar. The predictive potential appears to be greater for the hard sphere-type equations, but there remains a great deal of effort to be done before a fully predictive method for supercritical solubility is realized. 1 fig.

25124 **(DOE/PC/70806—T1) Liquefaction of coal by Polyporus versicolor and Poria monticola. Progress report, 1 January-31 March 1985.** Cohen, M.S. (Hartford Univ., West Hartford, CT (USA). Dept. of Biology and Health Science). 1985. Contract FG22-84PC70806. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010428.

Both Polyporus versicolor and Poria monticola were obtained from the American Type Culture Collection. Growth of Polyporus was shown to be faster and stronger than that of Poria under all conditions tested and the results reported here are based upon liquefaction of lignite coal by Polyporus. The liquefied coal samples were treated with acetonitrile which gave two fractions, a black precipitate and a light yellow liquid phase supernatant. This supernatant consists of acetonitrile and organic compounds which are soluble in acetonitrile. If the supernatant is drawn off with a Pasteur pipette followed by addition of water to the black precipitate, the precipitate dissolves instantly in the water producing a

black liquid. Using these techniques, the products of coal liquefaction have been divided into two phases which are soluble either in acetonitrile or in water. Both fractions have been analyzed by HPLC and compounds have been partially separated. No peaks have been identified. However, two principal peaks of the acetonitrile fraction have been sent to PETC for chemical analysis by GC-MS. 9 figs.

25125 **(DOE/PC/70814—2) Direct coal liquefaction using iron-titanium hydride as a hydrogen distribution and catalytic material. Quarterly report No. 2, December 1, 1984-February 28, 1985.** Smith, J.E. Jr. (Alabama Univ., Huntsville (USA). Dept. of Chemical Engineering). 28 Mar 1985. Contract FG22-84PC70814. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85009123.

During this reporting period the experimental apparatus was completed after substantial delays by the manufacturer. The equipment has been fully tested to familiarize the staff with its operating and safety procedures. An initial liquefaction study has begun on samples of Utah coal (60 microns or less) using 50 grams of iron-titanium alloy, 500 ml of tetralin, and 150 grams of powdered coal at 500°F and 500 psig. Results will be available in the next quarterly report. A new researcher has been added to the project to address the hydrogen absorption of new and recycled alloy samples. 2 figs.

25126 **(DOE/PC/71257—T1) Novel experimental studies for coal liquefaction. Quarterly progress report, October 1, 1984-December 31, 1984.** Holder, G.; Shah, Y.T.; Tierney, J.W. (Pittsburgh Univ., PA (USA)). 1984. Contract FG22-84PC71257. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85011538.

Research is being carried out in two areas which are of interest to ongoing investigations at the Pittsburgh Energy Technology Center. They are: thermal behavior of slurry reactors used for indirect coal liquefaction; and supercritical extraction and conversion of coal and oil shale using supercritical water. During this first quarter extensive modifications to the reactor were made which allowed measurement and control of the amount of liquid in the reactor. A non-reacting supercritical fluid, toluene, was studied to determine the effect of density on the coal extraction/reaction process. Extractions were carried out for 2 to 60 minutes at reduced densities between 0.5 and 2.0 and at temperatures between 647 and 698°K. The data obtained can be explained by the hypothesis that coal dissolution is required preceding liquefaction reactions and that the degree of dissolution depends upon solvent density and temperature. A kinetic model shows that the higher solvent densities result in faster conversion rates and in higher total conversions. A second factor that makes supercritical extraction attractive is high mass transfer rates. At high pressure, mass transfer rates in a supercritical fluid are much higher than in a liquid, despite the fact that the supercritical fluid has liquid-like solvent powers. 1 fig.

25127 **(EPRI-AP—3922-Vol.1) EDS coal liquefaction process development: Phase 5. Final technical progress report. Volume 1. Laboratory research and development and pilot plant operations.** (Exxon Research and Engineering Co., Florham Park, NJ (USA)). Apr 1985. Contract FC05-77ET10069. 207p. NTIS (US Sales Only), PC A10/MF A01; 1 - Research Reports Center, Box 50490, Palo Alto, CA 94303; GPO Dep. File Number DE85011443.

This report is the first volume of the Final Technical Progress Report for US Department of Energy Cooperative Agreement No. DE-FC05-77ET10069 for EDS Coal Liquefaction Process Development in the areas of Laboratory Research and Development and ECLP Project Management, Detailed Engineering, Procurement, Construction, and Operations. Volume II of the Final Report will cover Engineering Research and Development and the Hybrid Boiler Development Program, and Volume III will cover the Toxicology Program and the Bottoms Gasification Program. Funding for the program is shared by the US Department of Energy, Exxon Company, USA (a division of Exxon Corporation), Electric Power Research Institute, Japan Coal Liquefaction Development Company, Phillips Coal Company, Anaconda Minerals Company, Ruhrkohle AG and ENI. The agreement covers the period January 1, 1977 through December 31, 1985. The Laboratory Process Research and Development studies were conducted at various Exxon Research and Engineering Co. (ER & E) facilities: Research and Development Division at Baytown, Texas; Products Research Division at Linden, New Jersey; and the Exxon Research and Development Laboratories at Baton Rouge, Louisiana. The Engineering Research and Development studies were performed at the Exxon Engineering Petroleum and Synthetic Fuels and Exxon Engineering Technology Departments of ER & E at Florham Park, New Jersey. The information dealing with operation of the 250 T/D Exxon Coal Liquefaction Pilot Plant (ECLP) was generated at Exxon Company, USA, Houston, Texas. 41 figs., 34 tabs.

25128 **(EPRI-AP—3922-Vol.2) EDS coal liquefaction process development: Phase 5. Volume 2. Engineering research and development and hybrid boiler program. Final report.** (Exxon Research and Engineering Co., Florham Park, NJ (USA)). Apr 1985. Contract FC05-77ET10069. 153p. NTIS (US Sales Only), PC A08/MF A01; 1 - Research Reports Center, Box 50490, Palo Alto, CA 94303; GPO Dep. File Number DE85011444.

This report is the second volume of the Final Technical Progress Report for US Department of Energy Cooperative Agreement No. DE-FC05-77ET10069 for the EDS Coal Liquefaction Process Development and covers Engineering Research and Development and the Hybrid Boiler Program (Sections 3.6 and 3.7). Volume I covered Laboratory Research and Development and ECLP Project Management, Detailed Engineering, Procurement, Construction, and Operations. Funding for the program is shared by the US Department of Energy, Exxon Company, USA (a division of Exxon Corporation), Electric Power Research Institute, Japan Coal Liquefaction Development Company, Phillips Coal Company, Anaconda Minerals Company, Ruhrkohle AG, and ENI. The agreement covers the period January 1, 1977 through December 31, 1985. The Laboratory Process Research and Development studies were conducted at various Exxon Research and Engineering Co. (ER & E) facilities: Research and Development Division at Baytown, Texas; Products Research Division at Linden, New Jersey; and the Exxon Research and Development Laboratories at Baton Rouge, Louisiana. The Engineering Research and Development studies were performed at the Exxon Engineering Petroleum and Synthetic Fuels and Exxon Engineering Technology Departments of ER & E at Florham Park, New Jersey. The information dealing with operation of the 250 T/D EDS Coal Liquefaction Pilot Plant (ECLP) was generated at Exxon Company, USA, Houston, Texas. 5 figs., 29 tabs.

25129 **(EUR—9280-EN) To investigate methods of recovery, treatment and utilization of solids-bearing effluents emanating from coke ovens.** (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1984. 47p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

Methods of recovery, treatment and utilization of solids-bearing effluents emanating from coke ovens are investigated. Dewatering by means of decantation, filtration centrifuges, sedimentation centrifuges, vacuum filtration drum filters, belts-press-filters and agglomeration by special additives are described. The reduction of tar concentration in thickened slurries is achieved by the addition of crushed coal. Investigations of the effects of recycling carryover material upon the products of the coking process are made.

25130 **(NP—5770213) Determination of the solids residence time distribution of a fluidized bed reactor for coal gasification from the solids properties.** Hejny, H. (Essen Univ. (Gesamthochschule) (Germany, F.R.). Fachbereich Energie-, Verfahrens- und Elektrotechnik). 7 Jun 1983. 199p. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE85770213.

A procedure for the indirect determination of the residence time distribution of a solid from a sample of the gasification residue by the combination of screening and classification is presented. The ash from the gasifier was screened into narrow particle size fractions and these fractions were separated in a cutting classifier into

eleven classes depending on the sintering velocity. The solids density was the only parameter during the separation in the classifier. The burn-up distribution was determined by the analysis of the carbon content in the individual classes. The residence time distribution was determined subsequently by the use of a reaction kinetical formulation of first order.

25131 **(PB—85-153864/XAB) Vapor-liquid equilibria for coal liquids by gas chromatography. Final report, 1983-1984.** Arnold, D.W.; Juang, M.; Morgan, K. (Alabama Univ., University (USA). School of Mines and Energy Development). Nov 1984. 35p. NTIS, PC A03/MF A01.

Successful design of refineries and chemical plants requires accurate calculation of vapor-liquid equilibria (VLE). With advances in computing power, these calculations are increasingly being done by the equation of state (EOS) method. However, the interaction parameters for these EOS must be based on experimental data. The work done in this study involves measuring activity coefficients at infinite dilution for hydrocarbons and other compounds in an aromatic material such as flourene. Activity coefficients at infinite dilution are an optimum source of VLE data because solution effects are usually at a maximum at infinite dilution. An existing gas chromatograph has been extensively modified and tested to insure that reproducible infinite dilution activity coefficients can be obtained over a wide range of chromatographic operating conditions. Measurements are being made on additional systems at the present and there are plans to test other EOS.

25132 **(PB—85-159119/XAB) Statistically designed trial on Synthol units at Sasol's coal-to-oil plant at Secuda.** Royce, N.J.; Angus, S.M.; Kerr, P.T.B. (Imperial Coll. of Science and Technology, London (UK); Southampton Univ. (UK); Sheffield Polytechnic (UK)). Apr 1984. 24p. NTIS, PC E03/MF E01.

Summary in Afrikaans. Prepared in cooperation with Southampton Univ. (England), and Sheffield Polytechnic (England).

The authors planned and carried out between July and November 1983 a classical statistically designed trial on two Synthol synthesis units. The paper describes the reasons for and background to the trial, its design, and execution. Some conclusions that can be drawn from the resulting data are discussed.

25133 **(PB—85-159846/XAB) Coal-liquids distillation-tower corrosion. Chloride pathways in the Wilsonville, Alabama SRC-1 pilot plant when processing a high-chloride coal. Final report.** Davis, B.H.; Saguees, A.; Thomas, G.A.; Baumert, K.L. (Kentucky Univ., Lexington (USA). Inst. for Mining and Minerals Research; International Coal Refining Co., Allentown, PA (USA)). [1985]. 19p. (IMMR—83-082). NTIS, PC A02/MF A01.

Prepared in cooperation with International Coal Refining Co., Allentown, PA. Sponsored by Kentucky Energy Cabinet, Lexington.

The Wilsonville pilot plant experienced severe corrosion (> 1,000 mils/year) in the atmospheric fractionation column when processing a high-chloride (0.25 wt. %) coal. The operators found that the addition of sodium carbonate to the coal feed greatly reduced this corrosion but designers of a commercial plant could not use this corrosion control method. Hence, it was necessary to define the chloride pathway through the process. Samples collected during a brief operation without carbonate addition permitted a tentative conclusion about the chloride pathway. To provide a more definite pathway, the plant was operated for a three week period with a high chloride coal and samples were collected daily at more than 20 crucial sample points. Analysis of these samples clearly defined that the chloride pathway to the atmospheric fractionator was in the highest boiling distillate stream from the vacuum distillation column. A processing change near the mid-point of the three week run provided a marker to trace chloride through the process and provided further support for the pathway. Amines provide a transport mechanism for the chloride and provide, in addition, through thermal dissociation and recombination in fractionation columns, a mechanism for concentrating chlorides in a narrow region in the columns.

25134 **(PB—85-173813/XAB) Survey of town gas and by-product production and locations in the US (1880-1950). Final report, May-August 1984.** Eng, R. (Radian Corp., McLean, VA (USA)). Feb 1985. 467p. NTIS, PC A20/MF A01.

The report gives data compiled from available literature identifying plants that manufactured town gas from fossil fuels (e.g., coal, oil) and which existed in the U.S. from 1889 to 1950. The results are the first step of a preliminary study to investigate the fate and potential environmental impact of by-products (e.g., tar) from the manufactured gas industry. A list of gas manufacturing sites and company names was compiled by reviewing published gas statistics. It is estimated that more than 1,500 manufactured gas facilities existed from 1889 to 1950. In addition, available gasifier/process information and gas and by-product production data are reported. Based on these data, a rough (order of magnitude) estimate for the total production of tar by the U.S. manufactured gas industry was developed. It is estimated that about 15 trillion cu ft of gas was manufactured in the U.S. from 1880 to 1950, resulting in the production of 11 billion gal. of tar as a by-product. Of this estimated tar production, some tars were consumed at the plant site or sold and any excess discarded. Excess quantities of other by-products, such as coke and ammonia, may have been disposed of also. However, this study focused on tar because it is considered the more potentially significant waste disposal problem. The explanations and assumptions used in compiling the data are also discussed.

25135 **(STEV-TORV—83-3) System multibelt project. Stage I, 1983.** Karlsson, H.O. (Statens Energiverk, Stockholm (Sweden)). 1983. 256p. (In Swedish). NTIS (US Sales Only), PC A12/MF A01. File Number DE85750894.

The main goal for the program has been to develop and to test the equipment for a total peat production system from extraction in the bog through artificial dewatering to combustion. The central part of the dewatering system is the Multibelt press. The special feature of this press is that the pressure is stepwise increased during the passage of the material through the press. A high DMS (dry matter substance) can be obtained, being dependent of the press time. It is necessary to use drying to reach a DMS 50 per cent or higher. The cost for drying wet peat in conventional equipment is in the magnitude of SEK 115 to 180 per ton evaporated water. Further efforts are recommended in this area. When using mixed peat, a DMS level of only 23-25 per cent was obtained at the press operation. On an economic evaluation of the cost for producing hot water from alternatively artificially dewatered peat burnt in a turbo combustion unit or dried in a counter current dryer, alternatively dried with cheap waste heat, the cost levels showed to be of the same level as for harvested peat.

25136 **(STEV-TORV—83-9) Project HYDROTORV stage II 1983. Fractionation of peat fibers.** Karlsson, H.O. (Statens Energiverk, Stockholm (Sweden)). 1983. 212p. (In Swedish). NTIS (US Sales Only), PC A10/MF A01. File Number DE85750901.

The main goal of this program has been to test the performance of different component for artificial dewatering of peat and to evaluate their technical and economical potential. The efforts have been concentrated on fractionation of peat and purification of effluent water. The technical description of the final process is presented with a break-down of the cost for a full scale plant. The investment and production economy for a full scale plant with a capacity of 10 ton DMS (dry matter substance) per h have been calculated. The total investment is 21 MSEK. The production cost excluding extraction and in-transport for 25 per cent peat will be 166 SEK per ton DMS when running the plant in 5-shift. The total cost level for 85 per cent pellets is calculated to be 653 SEK per ton DMS. In comparison with cost for milled peat of 340 SEK per ton DMS the value for pellets should be 466 SEK per ton DMS. The best value for pellets produced through this fractionation method will be reached for small burners where the value added tax can be deducted.

25137 **SiC tubes exhibit excellent performance in fluidized-bed heat exchanger tests.** *Materials and Components in Fossil Energy Applications;* No. 54, 1-4(1 Feb 1985). (CONF-841043—). Contract AC21-80ET15020.

From 37. Pacific Coast regional meeting of the American Ceramic Society; San Francisco, CA, USA (28 Oct 1984).

A key consideration of heat exchanger materials is that they should have a long life in the service environment. Since SiC has thermal conductivity higher than most alloys, excellent high-temperature mechanical properties, excellent erosion-resistance, and an oxidation rate that is negligible to 982°C, long life as heat exchanger tubing in the environment of a fluidized-bed combustor (FBC) would be predicted. However, SiC material has not been evaluated in the FBC environment and information in the literature is not adequate to make an accurate prediction of SiC tube durability. Under certain combustion conditions within an FBC, it is possible that the oxidation rate of SiC might be accelerated due to continual removal of the protective layer of SiO_2, for example, by erosion; by dissolution of a glassy coating formed by impinging bed materials; or by the formation of SiO vapor rather than SiO_2. For these reasons, it was considered necessary to assess the durability of SiC as a viable heat exchanger surface by exposing it to an FBC environment. The objectives of the study were to: determine whether there is any surface wastage of SiC in the FBC environment and, if so, measuring the surface recession rate so that the life of the heat exchanger tubes can be predicted; determine whether there is any degradation of material strength; compare types of SiC; evaluate durability of Si/SiC joints; and determine how FBC operation parameters affect tube performance.

25138 **Overview of in-bed erosion in fluidized-bed combustors.** *Materials and Components in Fossil Energy Applications;* No. 54, 5-8(1 Feb 1985). (CONF-840570—).

From American Society for Metals materials for future energy systems conference; Washington, DC, USA (1 May 1984).

In the early days of the development of fluidized bed combustion, erosion in the bed was not thought to be a problem. A few instances had been noticed, but these were attributable to unusual conditions of one sort or another. However, as experience has developed, more and more cases of erosion have been reported. On the basis of current erosion criteria, erosion would appear to be unlikely in the bed of fluidized bed combustors operating under normal conditions. Erosion and methods for combatting it in fluidized bed combustors are discussed.

25139 **Compositions of distillate recycle solvents derived from direct coal liquefaction in the SRC-1 process 1. Hydrocarbons.** Boduszynski, M.M.; Allen, T.W.; Hurtubise, R.J.; Silver, H.F. (Chemistry Department and Chemical Engineering Department University of Wyoming, Laramie, WY). *Fuel;* 64: No. 2, 242-254(Feb 1985).

The qualitative and quantitative compositions of 260-427°C distillate recycle solvents derived from direct liquefaction of subbituminous Wyodak coal and bituminous Kentucky 9/14 coal in the SRC-1 process are discussed. A liquid chromatography method which involves a column switching technique was used to provide solubility characteristics and compound-class compositions. The hydrocarbon compounds, which account for >60 wt% of the distillate recycle solvents, were further analysed using a unique combination of high-performance liquid chromatography (h.p.l.c.) and field ionization mass spectrometry (f.i.m.s.). Thirty homologous series were identified. Carbon number and distribution and concentration of the homologous series were determined. The h.p.l.c./f.i.m.s. method unravelled various hydroaromatic types which otherwise would be very difficult or impossible to determine.

25140 **Distribution of some trace elements in the H-Coal Process Development Unit.** Schultz, H.; Adkins, J.W.; Booher, H.; Wells, A.W. (US Department of Energy, Pittsburgh Energy Technology Center, Pittsburgh, PA). *Fuel;* 64: No. 2, 273-278(Feb 1985).

To understand better the distribution and fate of some trace elements in coal liquefaction plant operated in a continuous mode, a study of six typical trace elements-Cd, Pb, Cr, Cu, Mn and Ni-was initiate at the HRI-operated H-Coal Process Development Unit at Trenton, NJ. Sampling was carried out carefull and the analytical effort was designed to prevent sample contamination and produce precise analyses. The results show that the trace elements studied enter the plant and remain associated with the denser, less volatile materials. Under equilibrium conditions there does not appear to be a buildup in the PDU of those trace elements studied.

25141 **Fluidized bed gasification of extracted coal.** Aquino, D.C.; DaPrato, P.L.; Gouker, T.R.; Knoer, P. (to Dept. of Energy). US Patent Application 6-628,079. 6 Jul 1984. 24p. Contract AC01-78ET13005.

Coal or similar carbonaceous solids are extracted by contacting the solids in an extraction zone with an aqueous solution having a pH above 12.0 at a temperature between 65°C and 110°C for a period of time sufficient to remove bitumens from the coal into said aqueous solution, and the extracted solids are then gasified at an elevated pressure and temperature in a fluidized bed gasification zone (60) wherein the density of the fluidized bed is maintained at a value above 160 kg/m^3. In a preferred embodiment of the invention, water is removed from the aqueous solution in order to redeposit the extracted bitumens onto the solids prior to the gasification step. 2 figs., 1 tab.

25142 **Process wastewater treatability study for Westinghouse fluidized-bed coal gasification.** Winton, S.L.; Buvinger, B.J.; Evans, J.M.; French, W.E.; Page, G.C.; Rhodes, W.J. (Radian Corp.). *Coal Technology;* 5: 125-138(Nov 1983). (CONF-831112—).

From Coal technology '83 - international coal utilization convention; Houston, TX, USA (15 Nov 1983).

In the development of a synthetic fuels facility, water usage and wastewater treatment are major areas of concern. Coal gasification processes generally produce relatively large volumes of gas condensates. These wastewaters are typically composed of a variety of suspended and dissolved organic and inorganic solids and dissolved gaseous contaminants. Fluidized-bed coal gasification (FBG) processes are no exception to this rule. The Department of Energy's Morgantown Energy Technology Center (METC), the Gas Research Institute (GRI), and the Environmental Protection Agency (EPA/IERLRTP) recognized the need for a FBG treatment program to provide process design data for FBG wastewaters during the environmental, health, and safety characterization of the Westinghouse Process Development Unit (PDU). In response to this need, METC developed conceptual designs and a program plan to obtain process design and performance data for treating wastewater from commercial-scale Westinghouse-based synfuels plants. As a result of this plan, METC, GRI, and EPA entered into a joint program to develop performance data, design parameters, conceptual designs, and cost estimates for treating wastewaters from a FBG plant. Wastewater from the Westinghouse PDU consists of process quench and gas cooling condensates which are similar to those produced by other FBG processes such as U-Gas, and entrained-bed gasification processes such as Texaco. Therefore, wastewater from this facility was selected as the basis for this study. This paper outlines the current program for developing process design and cost data for the treatment of these wastewaters.

25143 **Summary abstract: the role of potassium additives in nickel catalysts for CO hydrogenation: a surface science investigation.** Campbell, C.T.; Goodman, D.W. (Los Alamos National Lab., NM). *Journal of Vacuum Science and Technology, A: Vacuum, Surfaces, and Films;* 1: No. 2, 1265-1266(Apr-Jun 1983).

The effects of K upon the kinetics of the CO + H_2 reaction on Ni(100), i.e., to (1) decrease the rate of methane formation, and (2) promote the rate and selectivity of C_2/sub +/ formation, have also been observed for K additives in high surface area, supported Ni catalysts. This favorable comparison indicates that metal/support interactions are not required for the promoter effect, which must arise primarily from direct K-Ni interactions. 9 references, 1 figure.

0106 Properties

REFER ALSO TO CITATION(S) 25101, 25103, 25106, 25107, 25124, 25131, 25139, 25165, 25192, 25193, 25215, 25253, 25255

25144 (DOE/PC/30027—60, pp 101-124) **Determination of phenolic OH content in coal-derived distillates and resids by FTIR spectroscopy. Appendix 2.** Mar 1985. NTIS, PC A08/MF A01. File Number DE85011960.

In Recycle slurry oil characterization. Technical report, October 1983-March 1984.

In the characterization of recycle solvents, the concentration of total phenols has been used as an indicator of catalyst deactivation or of steady-state operation in liquefaction processes. The phenol content supplements other important chemical and structural characteristics of liquefaction solvents. The procedure described here is used to determine the total phenolic OH concentration of a sample in THF solution. Coal-derived distillate and THF-soluble resid samples may be analyzed by the method. The method uses the intensity (net absorbance) of the OH stretch band of phenols in the infrared spectra. This method differs from similar infrared methods largely by employing a solvent which is much better for coal-derived materials. Thus, this method may be applied to a substantially larger fraction of the total material available from liquefaction streams. Solvents typically used for such analyses will dissolve only about one-half of the material amenable to analysis by this method. This FTIR method offers certain advantages over the ^{19}F-NMR method previously used: it is simpler to perform, it takes less time per analysis, and it applies to tetrahydrofuran (THF) soluble resids (for which the ^{19}F-NMR method performs poorly). These concentration data are often used to characterize and evaluate recycle oils, but the resids have, in general, been poorly characterized. Results are included that show the method's reproducibility and comparability to an accepted method (^{19}F-NMR) for distillates. An application of this method to distillate and resid samples from Lummus ITSL Run 3LCF8 is also given. 13 refs., 7 figs., 5 tabs.

25145 **(DOE/PC/30027—60, pp 125-157) Residual oil characteristics in two-stage liquefaction. Appendix 3.** Winschel, R.A.; Robbins, G.A.; Burke, F.P. Mar 1985. NTIS, PC A08/MF A01. File Number DE85011960.

In Recycle slurry oil characterization. Technical report, October 1983-March 1984.

Residual oil is both a feed to and a product from the thermal first stage and the catalytic second stage in two-stage liquefaction and accounts for about 50% of the various internal process streams. The distillate product in two-stage liquefaction results from conversion of resid. It is important to measure chemical characteristics of residual oil because its properties affect process performance and are affected by processing conditions. Analytical techniques that provide little or no chemical information, such as solvent fractionation analysis, have only limited use for process monitoring. Earlier work with H-Coal PDU distillate oils demonstrated that proton distributions (^{1}H-NMR) and phenolic contents (^{19}F-NMR) were useful for monitoring process performance. In this paper, we demonstrate that proton distributions determined by ^{1}H-NMR and phenolic contents determined by a novel FTIR technique provide chemically meaningful information about residual oils that is sensitive to process changes. The application of these techniques relating residual oil characteristics to processing changes in Lummus ITSL Run 3LCF9 is discussed. 7 refs., 18 figs.

25146 **(DOE/PC/50797—T10) Novel analytical approaches to coal beneficiation. Quarterly report.** Griffiths, P.R. (California Univ., Riverside (USA). Dept. of Chemistry). 16 Apr 1985. Contract FG22-82PC50797. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010437.

Work during this period has centered on four areas: (1) continuing to define the components of coals which are the most susceptible to reactions such as oxidation; (2) better assignment of bands appearing in coal spectra after the application of Fourier self-deconvolution; (3) automation of routines for the application of curve-fitting algorithms to deconvolved coal spectra; (4) a careful characterization of the angular dependence of diffuse reflectance spectra.

25147 **(DOE/PC/60015—24) Separation and characterization of coal derived components. Report period: 1 January-31 March 1985.** Hurtubise, R.J.; Silver, H.F. (Wyoming Univ., Laramie (USA). Office of Univ. Research). 11 Apr 1985. Contract AC22-83PC60015. 16p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010395.

The general interpretation of field-ionization mass spectral data obtained from eight hydroxyl aromatic oils and asphaltenes fractions was carried out. The field-ionization mass spectral data showed considerable odd mass material in all the fractions indicating nitrogen compounds were present in the fractions. In preasphaltene experiments, elemental analysis data were obtained from nitrogen compound and hydroxyl aromatic fractions from chloroform-soluble preasphaltenes. In addition, work was initiated on the separation of pyridine soluble-chloroform insoluble preasphaltenes. Work was also begun on the separation of nitrogen compounds in oils and asphaltenes into pyridinic-types, carbazolic-types, and amino-types. In other work, a separation method was developed for the compound-class separation of components in oils and asphaltenes using high-performance liquid chromatography. Finally, several manuscripts were written. 1 fig., 3 tabs.

25148 **(DOE/PC/60804—T6) Thermophysical properties correlations and pseudocomponent characterization parameter estimation for fossil fluids. Second quarterly report, December 1, 1984-February 28, 1985.** Starling, K.E.; Lee, L.L.; Ellington, R.T.; Watanasiri, S.; Brule, M.R.; Kumar, K.H.; Khan, M.A.; Langenberg, M.A.; Mannan, M.; Sheth, K. (Oklahoma Univ., Norman (USA). School of Chemical Engineering and Materials Science). 1985. Contract FG22-83PC60804. 19p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85009297.

This report summarizes work performed during the period December 1, 1984 and February 28, 1985. During this quarter, a literature search was conducted to identify available data for dilute-gas thermal conductivity and dense-gas viscosity. After entering the additional data into the existing data bank and evaluating the data for quality, a literature search was conducted to study and compare various existing correlations for dilute-gas thermal conductivity. An evaluation of various correlations for dilute-gas thermal conductivity is presented in Section 2. A novel fluidity factor approach was also examined for its capability to correlate dense-fluid viscosity. Details of this methodology are presented in Section 3. 25 refs., 3 figs., 3 tabs.

25149 **(DOE/PC/60811—6) Mobile phase in coals: its nature and modes of release. Technical progress report, December 1984-February 1985.** Given, P.H.; Derbyshire, F.J. (Pennsylvania State Univ., University Park (USA). Coal Research Section). 1985. Contract FG22-83PC60811. 44p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85011696.

The concept that a substantial fraction of guest molecules is trapped within the macromolecular network of coals has undergone some modification since the proposal that led to the funding of this project was written. Accordingly, the strategy to be followed has been revised somewhat. It is now predicted that the polycyclic alkanes and long-chain alkyl aromatics to be used in this project as markers for the mobile phase should be extractable from suitable coals by ethylene diamine or a methylcyclohexanone/dimethylformamide mixture. This prediction is being tested. It would follow, if the hypothesis is correct, that a substantial part of liquefaction consists of the liberation of physically trapped material of quite low molecular weight. A further 19 coals have been sealed in pyridine-d_5 for pulsed free-induction-decay ^{1}H nmr; this completes the set of 24 coals to be studied by this technique, in an experiment designed to obtain information on the variation of the mobile phase with rank and geological history. A sample from the Illinois No. 6 seam has been extracted with a benzene/ethanol mixture under Soxhlet conditions and at 100°C in an autoclave for 3, 24 and 96 hours. A fairly systematic increase in extract yield and in the hexane-soluble portion is observed. The same coal has been extracted under various conditions with other, more polar, solvents, which yielded less or no more hexane-solubles than benzene/ethanol. Indoline has been reported to be a better donor solvent than tetralin. It has now been found that this is certainly true for 3 coals if conversion is defined by THF solubility. Research has been continued in exploring dry catalytic coal hydrogenation as a technique by which to examine the compositions and relationships of the molecular phase and network. It has been confirmed that the impregnated molybdenum catalyst should be present in the fully sulfided form in order to attain high catalytic activity. 22 refs., 3 figs., 17 tabs.

25150 (DOE/PC/70792—T2) Guest molecules in coal. Second quarterly report, December 1, 1984-March 31, 1985. Narayan, R. (Purdue Univ., Lafayette, IN (USA)). Mar 1985. Contract FG22-84PC70792. 22p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010435.

A series of control experiments using potassium, crown ether and tetrahydrofuran in the absence of coal have established that degradations or side reactions due to the K-CE-THF interactions is not significant. 17 to 20% THF solubles has been consistently obtained after K-CE treatment. A second K-CE treatment produced another 20% THF solubles. IR and TGA seemed to indicate that the same type of THF soluble fragments were released during both treatments. Work is currently being done using a well characterized coal sample from the Illinois Basin coal sample program. Thermal analysis of the coal extracts and residues from the coal-K-CE reaction were performed. 8 figs., 5 tabs.

25151 (DOE/PC/70793—T2) Application of the reference intensity method to coal analysis. Quarterly report, 1 January-31 March 1985. Davis, B.L. (South Dakota School of Mines and Technology, Rapid City (USA). Inst. of Atmospheric Sciences). 1985. Contract FG22-84PC70793. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85009528.

The objective is to develop a methodology for quantitative multicomponent analysis of crystalline and amorphous components in coal using the reference intensity procedure. During this quarter reference intensity constants completed on pyrite, marcasite, mackinawite and bassanite. The asher has operated perfectly since it was installed and the first real run has proved successful. Whole coal and ashed coal materials were analyzed by x-ray diffraction and x-ray transmission. Data obtained were in good agreement with the Penn State data. 2 tabs.

25152 (DOE/PC/70809—T1) Microbial screening test for lignite degradation. Quarterly progress report No. 1, January-March 1985. Yen, T.F. (University of Southern California, Los Angeles (USA)). 1985. Contract FG22-84PC70809. 37p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85009911.

Potassium permanganate and sodium hypochlorite oxidation of lignitic coal were performed. Ion chromatography of low molecular weight carboxylic acids - oxalic acid, formic acid, and acetic acid - produced by potassium permanganate and sodium hypochlorite oxidation was executed. Oxalic acid was found to be the most predominant low molecular weight species. It was estimated that about 10% of the carbon present in the chemical structure of lignite was converted to oxalic acid by sodium hypochlorite oxidation. Ion chromatography analysis showed that about 43% of the lignite carbon was converted to carbon dioxide in all experiments. Biological degradation of lignite by P. versicolor, a white-rot fungus, on lignite/agar and lignite slurry was attempted. Apparently, P. versicolor is capable of growing on lignite slurry. Acclimation of P. versicolor to lignite was proceeded. Biochemical reaction test for laccase production of P. versicolor was performed and found to be positive. 15 refs., 5 figs., 6 tabs.

25153 (NP—5770271) Determination of bond enthalpy from desorption isotherms of a Rhenish brown coal in the range of high temperature. Opdenwinkel, H. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Bergbau und Huettenwesen). 24 Nov 1983. 89p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE85770271.

The bond enthalpy of Rhenish raw brown coal was calculated from measured sorption isotherms via the isosterics of sorption. Based on the thermodynamic fundamentals, an equation was derived by which the bond enthalpy could be calculated from a group of sorption isosters derived from a group of sorption isotherms. Of the available methods of water vapour sorption measurement, a set-up tailored to the drying technique commonly applied was chosen for determining the sorption isotherms.

25154 (PB—85-159630/XAB) Chemical and physical characteristics of South African coal and a suggested classification system. Snyman, C.P.; van Vuuren, M.C.J.; Barnard, J.M. (National Inst. for Coal Research, Pretoria (South Africa)). 1983. 115p. NTIS, PC E06/MF E01.

Coal is a readily combustible rock containing more than 50 per cent by mass and more than 70 per cent by volume of carbonaceous material, including inherent moisture. It is formed from compaction and induration of variously altered plant remains, similar to those of peat. Differences in the kind of plant material (type), in degree of metamorphism (rank) and in range of impurity (grade) are characteristic of coal and are used for classification purposes. In terms of this definition of the American Society for Testing Materials coal is characterized by its complexity. Three fundamental and independent methods of coal classification can, therefore, be distinguished: Coal grade; Coal type; Coal rank.

25155 (PB—85-174936/XAB) Laser micropyrolysis of coal macerals. Annual report, November 1983-October 1984. Vastola, F.J.; McConnell, A. (Pennsylvania State Univ., University Park (USA)). Dec 1984. 28p. NTIS, PC A03/MF A01.

See also PB84-181981.

The mass spectra of the pyrolysis products of coal macerals have been obtained by heating the macerals, in monolithic coal sections situated within the ionization chamber of a time-of-flight mass spectrometer, with focused laser radiation. The analysis of the pyrolysis spectra of polymers taken under the same conditions indicates that laser heating produces primary free-radical fragments of the original structure. Comparison of the polymer spectra with spectra obtained from the vitrinite maceral of several coals indicate that vitrinite is mostly composed of a limited number of one and two ring methyl and hydroxy substituted aromatic structures. A study has been made of the affect of low temperature oxidation on the structure of coal. Oxidation tends to make the coal more thermally stable. With increasing oxidation the pyrolysis temperature increases and the yield of higher molecular weight fragments decreases.

25156 Thermoplastic properties of coal at elevated pressures, 2. Low-temperature preoxidation of a Pittsburgh Seam coal. Rashid Khan, M.; Jenkins, R.G. (Department of Materials Science and Engineering, The Pennsylvania State University, University Park, PA). *Fuel;* **64**: No. 2, 189-192(Feb 1985).

The thermoplastic properties of a preoxidized Pittsburgh Seam HVAb coal (air-treated at 383 K to different levels of weight gain) were examined using a high-pressure microdilatometer over a range (0.12.9 MPa) of pressures. The results suggest that the thermoplastic properties of the coal, depending on the extent of preoxidation, can be significantly different at elevated pressures from those at atmospheric pressure. The maximum swelling parameters of this preoxidized coal are always lower than those of untreated coal at pressures <1.0 MPa. However, >2.0 MPa, the maximum swelling parameters of the mildly oxidized samples are, in general, greater than those of untreated coal.

25157 Resolution enhancement of diffuse reflectance I.R. spectra of coals by Fourier self-deconvolution. 1. C-H stretching and bending modes. Wang, S.H.; Griffiths, P.R. (Department of Chemistry, Ohio University, Athens, OH). *Fuel;* **64**: No. 2, 229-236(Feb 1985).

Infrared spectra of many coal samples ranging from anthracites to lignites were measured by diffus reflectance Fourier transform infrared spectrometry. The technique of Fourier self-deconvolution was applied to reduce the widths of all bands in the spectra. Several bands absorbing between 3000 and 2800 cm^{-1} due to C-H stretching modes of alkyl groups in different environments could be resolved. In the spectral region between 900 and 700 cm^{-1}, aromatic C-H out-of-plane deformation modes due to monocyclic and polycyclic rings could be distinguished after deconvolution.

25158 **Direct measurement of organic sulphur in coal.** Hsieh, K.C.; Wert, C.A. (Department of Metallurgy and Mining Engineering University of Illinois, Urbana-Champaign, Urbana, IL). *Fuel;* 64: No. 2, 255-262(Feb 1985).

A method of direct determination of the organic sulphur content of coal has been developed using the transmission electron microscope. An electron beam is focussed on a thinned section of coal and X-ray emitted from the elements in the volume irradiated by the electrons are measured by X-ray emission spectroscopic methods. Both the characteristic K α line of sulphur and the bremsstrahlung from the material in the irradiated volume are detected by a solid-state detector. An analytical method has been developed which uses these two measurements for a direct determination of the organic sulphur concentration. Minerals can easily be avoided since they are plainly seen by conventional electron microscope techniques. Several measurements of the organic sulphur concentration in coals have bee made; they agree with the conventional chemical values reported for these coals. Of most importance, though, is the use of this technique to detect spatial variations of sulphur over small distances within the coal maceral.

0108 Waste Management

REFER ALSO TO CITATION(S) 25129, 25142, 25768

25159 **(DOE/FE/60181—120) Evaluation of treated gasification wastewater as cooling tower makeup.** Galegher, S.J.; Mann, M.D.; Johnson, M.D. (North Dakota Univ., Grand Forks (USA). Energy Research Center). Apr 1985. Contract FC21-83FE60181. 18p. (CONF-850565—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010158.

From 13. biennial lignite symposium on technology and use of low-rank coals; Bismarck, ND, USA (21 May 1985).

The principal goal of gasification research at the University of North Dakota Energy Research Center (UNDERC) is to develop process and environmental data on the treatability and reuse of aqueous effluents from the fixed-bed gasification of lignite. It is the objective of the UNDERC wastewater research program to define the extent of treatment required to produce a gas liquor for use as cooling tower makeup that will have no adverse effects on operating equipment or on the environment. The UNDERC pilot wastewater treatment scheme was designed to simulate the wastewater reuse process being used at the Great Plains Gasification Associates (GPGA) lignite gasification facility near Beulah, North Dakota. At GPGA, aqueous gasifier waste streams are treated via the Phenosolvan and Phosam-W processes to remove the bulk of the wastewater organics as well as ammonia and acid gases. This minimally treated wastewater, referred to as stripped gas liquor (SGL), is fed to the process cooling towers. At UNDERC, SGL was produced from a pilot slagging fixed-bed gasifier (SFBG) followed by extraction and steam-stripping treatment. UNDERC wastewater was used initially to determine the effects of cooling tower wastewater reuse before GPGA wastewater became available. An additional cooling tower reuse test was performed with water from GPGA. This work addresses the comparative effects of wastewater from the UNDERC slagging gasifier and the GPGA dry-ash gasifier on cooling system operation. 14 refs., 6 figs., 5 tabs.

25160 **(DOE/PC/73226—T1) Combined NO/sub x// SO/sub x/ control from flue gas using an electrochemical membrane concentrator. Six month progress report.** Winnick, J. (Georgia Inst. of Tech., Atlanta (USA). Research Inst.). Feb 1985. Contract FG22-84PC73226. 40p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85009834.

The electrochemical reactions have been studied in (Kn/Na) HSO_4 and $K_2S_2O_7$ with gas phase oxygen, sulfur oxides, and water vapor. In the bisulfate system the results show a marked effect of SO/sub x/ content, with exchange currents three orders of magnitude greater than those in its absence. In the pyrosulfate melt, addition of 1% V_2O_5 was found to enhance SO_2 removal with applied current. Reaction schemes have been presented which are mostly consistent with these and other results. The schemes are not considered firm; there remain some inconsistencies and uncertainties. The kinetic parameters obtained are in keeping with those required for economic performance in a commercial electrochemical device. The composite size of the kinetic currents and the relative stability indicate that potassium pyrosulfate with 1% vanadia is the electrolyte of choice. 19 refs., 5 figs., 6 tabs.

25161 **(EPRI-CS—3921) Workshop on sampling and analysis of utility pollutants: proceedings.** Chow, W.; Maddalone, R.F.; Scott, J.A.W. (comps.). (TRW, Inc., Redondo Beach, CA (USA)). Apr 1985. 202p. (CONF-830289—). Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920589.

From Workshop on sampling and analysis of utility pollutants; Los Angeles, CA, USA (8 Feb 1983).

The Seminar/Workshop on the Sampling and Analysis of Utility Pollutants was part of an overall EPRI effort to: Assess the pollutants of concern to the steam electric power industry, Survey current sampling and analysis methods, Identify improved, simplified, or more cost-effective sampling and analysis procedures, Compile a sampling and analysis reference guide for industry-wide usage, Conceptualize future EPRI research and field qualification activities. The two day meeting on February 8 and 9, 1983, at the Sheraton Plaza La Reina Hotel, Los Angeles, was designed to elicit from utility representatives their experience with and suggested solutions to trace element sampling and analysis problems in power plant aqueous discharge streams. Information from this meeting will be used in evaluating methods for the sampling and analysis reference guide being prepared by EPRI for the utility industry. This volume contains texts of the formal presentation and summaries of the working group recommendations. Separate analytics have been done on each chapter.

25162 **(KHM-TR—57) Purification of flue gas from coal-fired power plants.** Ericsson, S.O.; Skaar, M.; Tollin, J.; Aabyhammar, T. (Statens Vattenfallsverk, Vaellingby (Sweden). Projekt KOL-HAELSA-MILJOE). Apr 1983. 392p. (In Swedish). NTIS (US Sales Only), PC A17/MF A01. File Number DE85750873.

This report is primarily concerned with the description of commercially available and tried techniques for separation of dust, SO_2 and NO(sub)x from flue gases from coal fired boilers. The separation efficiency of the electrostatic precipitators (ESP) is very much dependent on the coal quality. The sulphur content is of significant importance and a high sulphur content facilitates the dust separation. The degree of separation for a given ESP can be improved with additions to the flue gases before the passage through the ESP, conditioning. The fabric filters are less sensitive to variations in coal quality, but not altogether insensitive. A special problem with the fabric filters are their sensitivity to high and low temperatures. High temperatures will damage the filter material, which can soften or melt. Sulphuric acid can at low temperatures condensate and result in a permanent blocking of the filter material. If a fabric filter is used an efficient dust separation is achieved (up to 99.9 %) whether it is required or not. Fabric filters can therefore compete with electrostatic precipitators. Cyclones are considerably cheaper than ESP and fabric filters and gives 5-10 times greater emissiom. Flue gas desulphurisation (FGD) can be achieved with wet, dry or wet-dry processes. The cost for flue gas desulphurisation are higher than for any other type of flue gas cleaning. Many techniques for denitrification of flue gases are under development and in Japan a couple are used commercially. The plants using catalytic reduction of nitrogen oxides are mainly gas fired or oil fired. Several processes for a simultaneous separation of nitrogen and sulphurdioxide are under development. None is yet available on a commercial scale.(author).

25163 **(KHM-TR—89) Mercury collection in an electrostatic precipitator and a flue gas desulphurization unit.** Bergstroem, J. (Statens Vattenfallsverk, Vaellingby (Sweden). Projekt KOL-HAELSA-MILJOE). Apr 1983. 46p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. File Number DE85750879.

Measurements of the mercury flow in the pulverized coal fired steam boiler at Studsvik were carried out under a contract from the project KHM. The aim of the work was to present distribution data of mercury in the flue gas and the ashes removed from the boiler, the electrostatic precipitator (EP) and the flue gas desulphurization unit (FGD). The experiments were carried out during four days. One day the pulverized coal flame was spiked with mer-

cury nitrate dissolved in water. The overall mercury balances showed that 50-70 % of the mercury from the coal was found in the ash from the EP. About 75 % of the mercury in the flue gas behind the EP was found to be water soluble. The FDG-unit is a semi dry scrubber and a pulse cleaned bag filter. Mainly water soluble mercury was removed in that unit. The total removal of mercury in the plant was 75 % or more. By spiking the mercury flow in the boiler was almost doubled. The first few hours did not show any increase of mercury in the ashes or the flue gas. After five to seven hours of spiking the mercury flow in the flue gas before the EP was increased, but still no influence of the spiking could be indicated behind the EP. The results gives credence to the hypothesis of a mercury sorption mechanism influenced by the operation parameters and the fly ash properties. It will take many hours to reach mercury equilibrium in a plant after change in the mercury flow with the fuel.(author).

25164 **(KHM-TR—92) Use of residues from small coal combustion plants.** Tingne, L.; Aagren, E.; Berg, I. (Statens Vattenfallsverk, Vaellingby (Sweden). Projekt KOL-HAELSA-MILJOE). Jun 1983. 215p. (In Swedish). NTIS (US Sales Only), PC A10/MF A01. File Number DE85750876.

In the project residues from coal combustion plants are studied in regard to treatment methods, recycling possibilities, as well as transport and handling methods. The properties of different kinds of residues from conventional plants as well as fluid bed combustion are presented. Normally 10-13 % of the used coal quantity will remain as ash and in fluid bed the addition of used bed material will give approximately 20 % residues. By treating the residues the properties and the quality can be changed to fit the demands from possible users. These treatment methods include crushing and screening to get a better grain-size distribution and for example sintering to form a new type of material. The most common use of flyash today and possibly also in the future in Sweden will be for production of cement and concrete. The quantity is expected to be 200-300 ktons in 1990. The quality requested will be hard to meet for small coal combustion plants. An other important field of usage for flyash as well as bottom ash, is as a filling material. Different methods and equipment for handling, storing and transporting coal ash and others residues have also been studied. Container systems will play a role for distributing residues from small combustion plants. As a part of the project a region in Middle Sweden has been studied. A production of 73000 tons of flyash, 28000 tons of bottom ash and 28000 tons of desulfurization products is expected 1990. The market situation in the region implies that flyash will be used for cement and concrete production. The bottom ash will probably be marketed as filling material and the desulfurization products might be used for production of gypsum boards in a local industri. Totally 75 % of the produced residues should be possible to use.(author).

25165 **(NP—5770276) Evaluation of methods for coal liquefaction residues characterization.** Morys-Kolm, M. (Technische Univ. Clausthal, Clausthal-Zellerfeld (Germany, F.R.). Fakultaet fuer Bergbau, Huettenwesen und Maschinenwesen). 3 Jun 1983. 138p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85770276.

The dissertation evaluates methods for characterizing coal liquefaction residues. The common methods of coal analysis are applied to the coal liquefaction residues for this purpose.

25166 **(PB—85-169860/XAB) Relationship of fly ash composition, refractive index, and density to in-stack opacity. Final report, June 1981-May 1982.** Cowen, S.J.; Ensor, D.S. (Atmospheric Research Group, Inc., Altadena, CA (USA)). Feb 1985. 66p. NTIS, PC A04/MF A01.

The report gives results of an investigation of the refractive index, density, and composition of fly ash from coal-fired boilers, aimed at determining: (1) the interrelationship of refractive index and composition, and (2) the significance of ash properties on in-stack plume opacity. A survey was made of 14 ash samples representing a wide range of coals. Light absorption was measured using the Integrating Plate Method, which compares light absorption through a clean filter to that through a filter with a single layer of aerosol. Only absorption is measured, while scattered light is integrated equally for both cases. This technique requires fine particles (volume absorbers) for easy interpretation of results. The technique was calibrated using an aerosol, methylene blue, with known absorption characteristics. The real part of the refractive index was measured by an oil immersion technique. The real refractive index and density were found to be highly correlated with composition with a multilinear regression equation. The absorbing refractive index was well correlated with ash carbon content. The modeling of in-stack opacity showed a weak dependence on ash optical properties for the range of ashes studied. The effect of the real part of the refractive index on opacity tends to be counterbalanced by particle density effects. Furthermore, most fly ash absorbs relatively little light.

25167 **Engineering properties and leaching tendencies of reuse products containing lignite fly ashes.** Thompson, C.M.; Ness, H.M. (Radian Corp., Austin, TX). *Coal Technology;* 6: 235-262(Nov 1983). (CONF-831112—).

From Coal technology '83 - international coal utilization convention; Houston, TX, USA (15 Nov 1983).

An alternative to disposing of at least part of the large quantities of ashes produced by lignite combustion in modern steam electric generating stations is to use them. If ashes are to be used, the reuse products must have acceptable physical properties and environmental characteristics. Laboratory studies were carried out to evaluate physical stability and leachate generation potential. Test materials representing four types of reuse were prepared in the laboratory. These were: Stabilized roadbase (fly ash plus lime); Soil stabilization (soil plus fly ash); Partial cement replacement (cement plus fly ash); and Asphalt filler (asphalt plus fly ash). Test specimens were prepared with three lignite fly ashes for each of the four reuse options. Physical stabilities of reuse products, as measured by standard materials testing methods, were acceptable to excellent in each case for two of the three ashes tested. Each ash yielded at least one acceptable reuse product.

0109 Environmental Aspects

REFER ALSO TO CITATION(S) 25184, 25185, 25812, 26073, 26074

25168 **(DOE/RG/10312—1-Vol.1) Technical Guide for estimating fugitive dust impacts from coal handling operations. Volume I. Project summary .** Howroyd, G.C. (Dames and Moore, Atlanta, GA (USA)). Sep 1984. Contract AC01-80RG10312. 14p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010948.

The use of coal at power plants and other fuel-burning installations can result in fugitive dust emissions generated by the handling and storage of coal. At some installations, the storage and handling of fly ash and limestone can also result in fugitive dust emissions. To aid analysts, planners, and managers in evaluating the significance of fugitive dust emissions, a Technical Guide has been developed. The development of the Technical Guide was based on a comprehensive review of existing literature on fugitive dust emission sources and emission control measures. From this review, recommended emission factors were developed for 13 different emission source categories. To account for the use of dust controls, the Technical Guide recommends ranges of control efficiencies that can be expected for the many types of control methods appropriate for the suppression of fugitive dust emissions. The Technical Guide makes specific recommendations on modeling analysis procedures that take into account such factors as the size and configuration of the emission source, meteorological variations, and dust settling and deposition. These dispersion analysis techniques are applied to a realistic example problem as an aid to the Technical Guide user. The example problem is first assessed by a conservative screening method using diagrams contained in the Technical Guide. The example problem is also considered through a more elaborate modeling approach so that the Technical Guide user can gain an understanding of the procedures involved when detailed modeling is preferred or required. 2 figs., 2 tabs.

25169 (DOE/RG/10312—1-Vol.2) Technical Guide for estimating fugitive dust impacts from coal handling operations. Volume II . Howroyd, G.C. (Dames and Moore, Atlanta, GA (USA)). Sep 1984. Contract AC01-80RG10312. 170p. NTIS, PC A08/MF A01; GPO Dep. File Number DE85010939.

The use of coal at power plants and other fuel-burning installations can result in fugitive dust emissions generated by the handling and storage of coal. At some installations, the storage and handling of fly ash and limestone can also result in fugitive dust emissions. To aid analysts, planners, and managers in evaluating the significance of fugitive dust emissions, a Technical Guide has been developed. The development of the Technical Guide was based on a comprehensive review of existing literature on fugitive dust emission sources and emission control measures. From this review, recommended emission factors were developed for 13 different emission source categories. To account for the use of dust controls, the Technical Guide recommends ranges of control efficiencies that can be expected for the many types of control methods appropriate for the suppression of fugitive dust emissions. The Technical Guide makes specific recommendations on modeling analysis procedures that take into account such factors as the size and configuration of the emission source, meteorological variations, and dust settling and deposition. These dispersion analysis techniques are applied to a realistic example problem as an aid to the Technical Guide user. The example problem is first assessed by a conservative screening method using diagrams contained in the Technical Guide. The example problem is also considered through a more elaborate modeling approach so that the Technical Guide user can gain an understanding of the procedures involved when detailed modeling is preferred or required. 247 refs., 39 figs., 15 tabs.

25170 (DOE/SF/00098—T5) Reduction of pollutant formation in combustion processes. Sawyer, R.F. (Lawrence Berkeley Lab., CA (USA)). [1985]. Contract AC03-76SF00098. 23p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010181.

Combustion sources account for approximately ninety percent of air pollutant emissions. Many of the effects of air pollutants upon human health and the environment are reasonably well understood. Some potential problems, however, such as the presence of carcinogens in urban atmospheres and the effect of carbon dioxide on climate, while not well understood, cause concern. Modification of combustion processes to reduce pollutant emissions has proven successful. Better understanding of the fundamentals important to combustion often leads to pollutant reduction without compromise of efficiency or the quality of the combustion process. Treatment of combustion products to remove pollutants also has proven effective in cases where combustion modification fails to yield the required reduction. In other cases treatment of the fuel to remove pollutant precursors has been employed. A combination of these approaches has been chosen as an optimum strategy for some pollution control situations. 7 refs., 7 figs., 4 tabs.

25171 (EPRI-CS—3901-Vol.2) Groundwater manual for the electric utility industry. Volume 2. Groundwater-related problems. Final report. (Southern Co. Services, Inc., Birmingham, AL (USA)). Mar 1985. 377p. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303. File Number TI85920596.

This manual was developed under the auspices of EPRI's Solid By-Products and Hazardous Waste Disposal subprogram to provide electric utility personnel with a user-oriented reference document that focuses on groundwater considerations frequently addressed by power companies. The major areas of concern include the leaching of both solid wastes and stored coal, land subsidence and sinkhole development, and seepage away from all types of impoundments. These three groundwater considerations can produce substantial increases in the cost of generating electricity. Separate analytics have been done for each chapter.

25172 (PB—85-147296/XAB) Evaluation of ongoing mined-land reclamation on selected coal mines in North Dakota, Montana, Wyoming, New Mexico and Colorado. (Idaho Univ., Moscow (USA)). 1979. 72p. NTIS, PC A04/MF A01.

The Bureau of Land Management concluded that a system was needed to evaluate strip mined-land reclamation. Predictive methodologies have not been adequately evaluated or tested. The Bureau needs assurance that lease stipulations for coal leases are reliable and practical. A reclamation standard needs to be identified and a reclamation prescription developed by major land resource area. A study plan was developed by the Watershed Staff (D-350), Denver Service Center, that proposed methods to evaluate ongoing reclamation at selected coal strip mines within the major land resource areas having important coal resources. The objectives were: (1) to evaluate ongoing reclamation procedures used by the mining companies and/or identified by stipulations in the reclamation plan, (2) to identify the reclamation standard, and (3) to develop a reclamation prescription for the major land resource areas of the Northern Great Plains, Western Great Plains, Western Range Regions, and Southern Rocky Mountains. Field work was conducted in June 1978 by Dr. Maynard A. Fosberg, professor of soil science at the University of Idaho in Moscow under contract to BLM.

25173 (PNL—5460-Vol.2) MELSAR: a mesoscale air quality model for complex terrain. Volume 2. Appendices. Allwine, K.J.; Whiteman, C.D. (Pacific Northwest Labs., Richland, WA (USA)). Apr 1985. Contract AC06-76RL01830. 371p. NTIS, PC A16/MF A01; 1; GPO Dep. File Number DE85010991.

This final report is submitted as part of the Green River Ambient Model Assessment (GRAMA) project conducted at the US Department of Energy's Pacific Northwest Laboratory for the US Environmental Protection Agency. The GRAMA Program has, as its ultimate goal, the development of validated air quality models that can be applied to the complex terrain of the Green River Formation of western Colorado, eastern Utah and southern Wyoming. The Green River Formation is a geologic formation containing large reserves of oil shale, coal, and other natural resources. Development of these resources may lead to a degradation of the air quality of the region. Air quality models are needed immediately for planning and regulatory purposes to assess the magnitude of these regional impacts. This report documents one of the models being developed for this purpose within GRAMA - specifically a model to predict short averaging time ($\leq$ 24 h) pollutant concentrations resulting from the mesoscale transport of pollutant releases from multiple sources. MELSAR has not undergone any rigorous operational testing, sensitivity analyses, or validation studies. Testing and evaluation of the model are needed to gain a measure of confidence in the model's performance. This report consists of two volumes. This volume contains the Appendices, which include listings of the FORTRAN code and Volume 1 contains the model overview, technical description, and user's guide. 13 figs., 10 tabs.

25174 (USGS/WRI—81-1014) Potential hydrologic effects of developing coal and other geoenergy resources in Oregon: a review. Sidle, W.C. (Geological Survey, Portland, OR (USA). Water Resources Div.). 1981. 34p. US Geological Survey, Box 25425, Denver Federal Center, Denver, CO 80225. File Number TI85901332.

Geoenergy resources in Oregon, in addition to coal, include noncommercial deposits of oil shale, natural gas, and geothermal heat. Commercial quantities of natural gas were discovered at Mist in northwestern Oregon in 1979. Gas presently is being produced from five wells and additional exploratory drilling is underway. More than 2 million acres of Oregon land is under lease for petroleum and natural gas exploration, mostly in the Astoria embayment-Willamette syncline, central (Oregon) Paleozoic-Mesozoic basin, and eastern Tertiary nonmarine basin. The Cascade Range and eastern Oregon contain sizable resources of geothermal heat, of which a small part has been developed for space heating at Klamath Falls and Lakeview. Thirteen Known Geothermal Resource Areas (KGRA's) comprising 432,000 acres have been identified, 422,000 acres are currently leased for geothermal development. KGRA's judged to have potential for generation of electrical power are Newberry Crater, Crump Geyser, and Alvord Desert. No adverse hydrologic effects have been noted to date from coal or other geoenergy exploration or development in Oregon, and no effects are expected if federal and state regulations are adhered to. The southwestern Oregon coals would have to be mined by underground methods. Potential hydrologic impacts would be local in-

creases in sedimentation, turbidity, and mineralization of surface and ground water. Water-quality degradation, including both thermal pollution and increased concentrations of dissolved minerals, could result from geothermal development. Other potential problems include land subsidence and consumptive use of water associated with both coal and geothermal development. 53 refs., 3 figs., 1 tab.

25175 **Impacts of proposed acid rain legislation S. 3041 and H.R. 3400 on the coal and electric utility industries.** Fuldner, A.H. (Energy Information Administration, US Dept. of Energy, Washington, DC). pp 103-116 of Coal Technology '84: Book I. Houston, TX; Industrial Presentations Inc. (1984). (CONF-841102—).

From 7. international coal utilization conference and exhibition; Houston, TX, USA (13 Nov 1984).

This paper analyzes the proposed "Clean Air Act Amendments of 1982" and the "National Acid Deposition Control Act of 1983." Senate bill S. 3041 calls for the establishment of an acid deposition region consisting of 31 states and the District of Columbia. House bill H.R. 3400 proposes decreasing SO_2 emissions in the 48 contiguous states by requiring certain fossil fuel-fired electric utility plants and other sources to reduce their SO_2 emissions by January 1, 1993 to 10 million tons below the level that those sources emitted in 1980. The least-cost means by which electric utilities could reduce their 1995 emissions of SO_2 to comply with the legislation are determined. The impacts the legislation would have on regional coal production, utility capital expenditures, and electricity prices are analyzed.

25176 **Effects of aquifer interconnection resulting from underground coal gasification.** Stone, R.; Raber, E.; Winslow, A.M. (Lawrence Livermore National Lab., Livermore, CA). *Ground Water;* **21**: No. 5, 606-618(Sep-Oct 1983). Contract W-7405-ENG-48.

An investigation was conducted to evaluate the effects of aquifer interconnection caused by the collapse of cavities formed in coal seams by two small underground coal gasification experiments in the Powder River Basin, Wyoming. The main objective of the work was to assess the magnitude and extent of changes in the ground-water flow patterns near the sites of the two experiments. Hydraulic head measurements in the three affected aquifers were used to calibrate a steady-state ground-water flow model of the interconnection zone at each site. Flow modeling and field measurements show that water from one or both of the upper aquifers enters the collapse rubble and flows away from the collapse zones. Changes in hydraulic head and flow patterns caused by aquifer interconnection extend generally only 200-300 ft (60-90 m) away from the experiment sites. At both experiments sites, aquifer interconnection allows water from the uppermost (sand) aquifer, which contains the poorest quality water of the three aquifers, to enter one or both of the underlying coal aquifers.

0110 Reserves And Exploration

25177 **(LA-UR—85-1466) Ash contents of Costa Rican peat deposits.** Raymond, R. Jr.; Cohen, A.D.; Bish, D.L. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 19p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010734.

Fourteen sites within 6 Costa Rican peat localities were sampled using MacCaulay samplers and soil augers. Sample localities included high mountain (>2500 meters), river floodplain, and Gulf coastal plain. Peat deposits ranged from as thin as 20 cm to greater than 460 cm. Within the peat deposits, ash (that material which will remain following combustion) occurs both dispersed within the peat layers and as layers containing nearly 100% inorganic material interstratified with the peat layers. Ash in Costa Rican peats includes material derived from both organic and inorganic origins. The predominant inorganically derived material is volcanic and may result from direct volcanic ashfall into the peat environment or as detritus transported into the peat areas. Volcanic ash is rapidly altered within the peats, leaving little if any relict structures. Alteration products are pedominantly kaolin and smectite clays and gibbsite. Unaltered minerals identified by x-ray diffraction include quartz, cristobalite, plagiolase feldspar, and anatase. Hematite and bassanite (identified by x-ray diffraction) are present but result from the alteration of iron-bearing minerals and organic sulfur or gypsum during sample preparation. Pyrite is present as a very minor component of some Costa Rican peats. Organically-derived ash constituents in Costa Rican peats include siliceous diatoms, siliceous sponge spicules, and silica phytoliths. The type and abundance of ash constituents within Costa Rican peats can be evaluated based on geographic location of the peat deposits, the geologic conditions affecting their deposition, and the plant communities existing during deposition. 6 refs., 11 figs., 3 tabs.

25178 **(PB—85-156339/XAB) Coal resources of the Hazard District, Kentucky: Breathitt, Knott, Leslie, Perry and parts of Harlan and Letcher counties.** Brant, R.A.; Chesnut, D.R.; Frankie, W.T.; Portig, E.R. (Kentucky Univ., Lexington (USA). Inst. for Mining and Minerals Research; Kentucky Geological Survey, Lexington (USA)). Sep 1983. 52p. (IMMR—83-086). NTIS, PC A04/MF A01.

Prepared in cooperation with Kentucky Geological Survey, Lexington. Sponsored by Geological Survey, Reston, VA, and Kentucky Energy Cabinet, Lexington.

This report is the fifth in the Energy Resource Series published by the University of Kentucky Institute for Mining and Minerals Research (IMMR), with the Kentucky Geological Survey (KGS). It summarizes the coal resources of the Hazard District (Breathitt, Knott, Leslie, Perry, and parts of Harlan and Letcher counties) of the Eastern Kentucky Coal Field as calculated by the Kentucky Geological Survey. Tonnage estimates for the individual coal beds in the district are presented in tabular form, along with resource maps of the major coal beds.

25179 **(PB—85-159820/XAB) Coal resources of the Big Sandy District, Kentucky. Floyd, Johnson, Martin, and Pike counties.** Brant, R.A.; Chesnut, D.R.; Frankie, W.T.; Portig, E.R. (Kentucky Univ., Lexington (USA). Inst. for Mining and Minerals Research). [1985]. 51p. (IMMR—83-087). NTIS, PC A04/MF A01.

Sponsored by Kentucky Geological Survey, Lexington and Kentucky Energy Cabinet, Lexington.

The Big Sandy District contained an estimated 20.30 billion short tons of original coal resources. Remaining coal resources (as of January 1, 1981) total an estimated 18.03 billion short tons. The coal resources are tabulated by standard U.S. Geological Survey resource methods. Of the 33 mineable coal beds and related benches or splits (14 inches thick or greater) that are known to occur in the district, six contain more than 58 percent of the estimated coal. Pike County contains 11.39 billion tons or 56 percent of the coal estimated for the district, followed by Floyd County with 4.17 billion tons or 21 percent of the district total. Martin County contains an estimated 3.32 billion short tons or 16 percent of the district total and Johnson County accounts for an estimated 1.42 billion tons of the coal resource or 7 percent of the district total.

25180 **(PB—85-166015/XAB) Kentucky energy resource utilization program. Annual report, 1 July 1981-30 June 1982.** Pettit, R. (Kentucky Univ., Lexington (USA). Inst. for Mining and Minerals Research). May 1983. 161p. (IMMR—83-083). NTIS, PC A08/MF A01.

See also PB85-110674. Sponsored by Kentucky Energy Cabinet, Lexington.

This report was published as part of the Commonwealth-sponsored energy research and development program under the auspices of the Kentucky Department of Energy (KDoE). It covers activities which were conducted by the University of Kentucky Institute for Mining and Minerals Research (IMMR) and funded by KDoE and other governmental and industrial sources from July 1, 1981 to June 30, 1982. The IMMR operates the Kentucky Center for Energy Research Laboratory (KCERL) in Lexington, Kentucky, and sponsors other energy-related activities throughout the Commonwealth. Topics include coal and oil shale resource assessment, coal and oil shale utilization and conversion technologies, materials engineering, mining technology, and reclamation.

25181 **(USGS-OFR—83-633) Geologic map and coal sections of the Pine Ridge quadrangle, Moffat County, Colorado.** Prost, G.L.; Brownfield, M.E. (Geological Survey, Denver, CO (USA)). 1983. 40p. US Geological Survey, Box 25425, Denver Federal Center, Denver, CO 80225. File Number TI85901358.

The Pine Ridge quadrangle was mapped as part of the US Geological Survey's program of classifying and evaluating mineral lands in the public domain. Coal is the primary resource of econmic interest within the quadrangle and occurs in the Lance and Fort Union Formations. Several unsuccessful oil-and-gas wells have been drilled within the quadrangle. Possible uranium deposits may be found in the Browns Park Formation. Sand and gravel are also present in the quadrangle. The main coal zone in the Lance Formation is found near the middle and contains coal beds ranging in thickness from 0.17 to 0.94 m. These coal beds are discontinuous, grading laterally and vertically into carbonaceous shales. The middle coal zone in the Lance Formation appears to be continuous from east to west across the quadrangle. Coal beds approximately 0.1 m thick occur locally just above the base of the Lance. There are no coal mines or prospects within the formation. Coal beds in the Fort Union Formation, although generally thicker than the Lance coals, are extremely lenticular and irregular in distribution. The Fort Union coal zone is 22 to 51 m thick and the lowermost coal bed is 36 to 177 m above the basal Fort Union contact. Coal beds pinch and swell, are split by shale and sandstone partings, are cut out by river-channel sandstones, and grade laterally and vertically into carbonaceous shales. Inferred coal resources were calculated for the Fort Union Formation coals. An estimated 3278 ha are underlain by approximately 195 million metric tons. Resources were not calculated for coal beds in the Lance Formation.

25182 **(USGS/WRI—83-4155) Ground-water hydrology before, during, and after coal strip mining of a small watershed in Coshocton County, Ohio.** Razem, A.C. (Geological Survey, Columbus, OH (USA). Water Resources Div.). 1983. 40p. US Geological Survey Open File Services, Box 25425, Denver Federal Center, Denver, CO 80225. File Number TI85901348.

Ground-water conditions before, during, and after surface mining of a small watershed are described as part of a study to determine the effects of mining on hydrologic systems. The watershed was underlain by stratified sedimentary rocks containing three aquifers. The top and middle aquifers were perched above clay beds that underlay the major coal seams; the lowermost aquifer is part of a regional aquifer system. Mining involved removing the overburden rocks (including the top aquifer), stripping the coal, and recontouring the overburden spoils to the approximate premining shape of the watershed. Replacement of the top aquifer by spoils during mining has caused many changes in the land surface, recharge rates, discharge rates, saturated thickness, water-table gradient, hydraulic conductivity, storage, and water quality. Changes in the middle aquifer include: the amount of recharge from precipitation, amount of leakage through the overlying clay bed, and water quality in some areas. Saturation of the mine spoils during postmining has been slow and irregular; saturated zones have ranged from zero to 5 feet in thickness. Water levels in wells in the middle aquifer have remained virtually unchanged. The water quality in the mine spoils is significantly poorer than in the original top aquifer. Specific conductance of water in the mine spoils is 2020 micromhos per centimeter and sulfate as much as 940 milligrams per liter compared to 120 micromhos per centimeter and 11 milligrams per liter in the original aquifer. Water levels and water quality in the deep aquifer have not been affected by mining. 8 refs., 16 figs., 3 tabs.

0120 Mining

REFER ALSO TO CITATION(S) 25937

25183 **(NP—5770204) Coal mining in the West German power industry in the year 1983.** (Statistik der Kohlenwirtschaft e.V., Essen (Germany, F.R.)). Sep 1984. 87p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE85770204.

Tables are presented with figures on black coal mining, brown coal mining, coal balances, energy consumption, reserves, foreign trade, and energy balances. World surveys in the appendix give information on coal, petroleum, and natural gas production, electric power and raw steel production according to the country and year.

25184 **(PB—85-153328/XAB) Evaluation of dust sources and control techniques for conventional mining. Volume 1. Field studies. Open file report, 26 February 1980-1 December 1982.** Rodgers, S.J. (MSA Research Corp., Evans City, PA (USA)). Mar 1983. 60p. NTIS, PC A04/MF A01.

See also PB85-153336.

This report represents the results of in-mine studies to determine the severity of dust sources in conventional mining operations. Three underground coal mines were surveyed using gravimetric samplers and continuous dust monitors. Two additional mines were surveyed using only monitors. Data on dust control methods were acquired during the survey. The results indicated that cutting drilling and loading out were the dustiest operations during a conventional mining cycle. Roof bolting, shot firing, and product transport were less severe dust sources.

25185 **(PB—85-153336/XAB) Evaluation of dust sources and control techniques for conventional mining. Volume 2. Guidelines. Open file report, 26 February 1980-1 December 1982.** Rodgers, S.J. (MSA Research Corp., Evans City, PA (USA)). Mar 1983. 71p. NTIS, PC A04/MF A01.

See also PB85-153328.

This report presents guidelines on methods of dust control in conventional coal mining operations. The normal mining cycle and equipment used in a room-and-pillar conventional section are described. Main ventilation, section ventilation, and face ventilation are discussed in detail. Proper installation of line brattice, maintenance of proper airflows at the face, and split ventilation are stressed. The effects of maintaining the end-of-the-line brattice near the face are described. The advantages and disadvantages of blowing and exhausting face ventilation are presented, and the use of water sprays on cutter bars and loading machines is described. The design of a nonclogging water spray system developed under a Bureau of Mines contract is presented. Other methods of reducing dust exposure are discussed and include alternative procedures for shot firing and administrative controls.

25186 **(PB—85-160141/XAB) Delayed blasting tests to improve highwall stability. A progress report. Report of investigations/1984.** Stachura, V.J.; Fletcher, L.R. (Bureau of Mines, Twin Cities, MN (USA). Twin Cities Research Center). 1984. 31p. (BM-IC—8916). NTIS, PC A03/MF A01.

Library of Congress Catalog Card No. 84-600214.

The Bureau of Mines conducted a series of delayed blasting experiments at a West Virginia contour coal mine that resulted in smoother highwalls. The highwalls were smoother due to reduced overbreak and inherently safer due to reduced likelihood of rockfall. Reduced overbreak was accomplished by an increase in the highwall hole delays, which changed the effective delay pattern geometry and the direction of burden movement. The results of the blast delay changes were evaluated using terrestrial photogrammetry to generate vertical profiles at regular intervals. This evaluation showed that delay changes produced generally smoother vertical profiles.

25187 **(PB—85-160976/XAB) Use of steel sets in underground coal. Information circular/1984.** Stears, J.H.; Serbousek, M.O.; Hay, K.E. (Bureau of Mines, Spokane, WA (USA). Spokane Research Center). 1984. 22p. (BM-IC—8992). NTIS, PC A02/MF A01.

The report presents information on the use of steel supports in U.S. coal mines, including accident statistics for a 3-yr period and a survey of present applications and problems. It also contains a summary of available steel arch configurations and a description of steel-support design criteria for ground-control applications.

25188 (HSE-Trans—8335) Investigations into coal-dust explosion hazards in longwall conveyor roadways. Stolecki, M. Translated from *Prace Glownego Instytutu Gornictwa ;* No. 694, vp(1978). 40p. NTIS (US Sales Only), PC A03. File Number DE85900942. DE85900942

Experiments carried out in the experimental gallery in conditions least conductive to the transmission of an explosion, confirmed the presence of a real threat of initiating and transmitting a coal dust explosion in the majority of the longwall conveyor roadways which had been investigated. Of particular interest are the results of coal dust explosion transmission over relatively short dust zones (up to 30 meters) with dust accumulations significantly in excess of the upper limit of combustibility. The conclusion which must be drawn from this is that even short-distance dust accumulations can constitute a serious explosion hazard. The averages of coal dust accumulations in various roadways cover a wide range and can be anything from 19 to 573 g m^{-3}. Measurements taken progressively from the face-line showed an increase in coal dust accumulation as a result of the progressively longer duration of coal dust settling. Large accumulations of coal dust are formed in places where the conveyor roadways pass through ventilation barriers or where the output is loaded. Coal dust in these sections settles in greater quantities than it does in other sections of the mines where the average dust accumulation is anything between 326 and 4010 g m^{-3}. The average accumulations of coal and stone dust mixtures in the various conveyor roadways is within the range 40 to 1375 g m^{-3}. In the majority of cases coal dust accumulations in conveyor roadways were far in excess of the lower limit of combustibility. The lines of coal dust accumulation in a width from 0.6 to 0.9 meters were observed under the conveyor belt. There were cases where coal dust settled at a rate of more than 80 g m^{-3} per day over a 100-meter section of the roadway. Such intensive settling creates a surface layer on top of the rock dust which is particularly hazardous in that it increases the possibility of transmitting a coal dust explosion.

0130 Transport And Handling

REFER ALSO TO CITATION(S) 25437

25189 (DOE/FC/10623—1775) Preparation and analyses of low-rank coals for combustion applications. First quarterly report, October 1, 1984-December 31, 1984. Smit, F.J. (AMAX Extractive Research and Development, Inc., Golden, CO (USA)). Jan 1985. Contract AC18-84FC10623. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010903.

This report covers the first quarter of activity on an 18-month project to prepare low-rank coal (LRC) fuel for research applications in DOE advanced combustion technologies programs. During the period, five coals, from Colorado, Wyoming, Montana and North Dakota, were obtained from operating mines and amenability tests begun to determine their suitability for production of low-ash micronized LRC and LRC-slurry fuels.

25190 (DOE/FE/60181—130) Production and combustion of hot-water dried low-rank coal slurries. Sears, R.E.; Baker, G.G.; Maas, D.J.; Potas, T.A.; Patel, R. (North Dakota Univ., Grand Forks (USA). Energy Research Center). Apr 1985. Contract FC21-83FE60181. 27p. (CONF-850565—2). NTIS, PC A03/MF A01; GPO Dep. File Number DE85009970.

From 13. biennial lignite symposium on technology and use of low-rank coals; Bismarck, ND, USA (21 May 1985).

Hydrothermal conditioning, in a water slurry at temperatures above 230°C, is one method which can significantly improve the quality and "slurryability" (bone-dry solids loading and slurry viscosity) of low-rank coals. Hot-water thermal conditioning of lignite and subbituminous coals has been found not only to change both the chemical and physical characteristics of the coal but also alters the coal's slurry rheological properties. These changes result because decarboxylation, mild pyrolysis, extraction, dehydration, and surface modification all occur during hydrothermal treatment. Concentrated low-rank coal/water slurries of >60% bone-dry solids have been achieved with pseudoplastic flow behavior and stability towards settling, without the use of additives. Heating values, on a per unit mass basis, for these slurries were only slightly less than the energy content of the as-mined coal. Chemical modifications and improvement in slurry rheological properties, due to hydrothermal treatment, were greater for lignites and brown coals, and less so for coals of increased rank. A 200 lb/hr Process Development Unit (PDU) has been constructed to demonstrate operability on a continuous basis and to produce slurry for pilot-scale combustion tests. 24 refs., 12 figs., 4 tabs.

25191 (DOE/PC/60045—T6) Integration of advanced preparation with coal liquefaction. Sixth quarterly technical progress report, January 1, 1985-March 31, 1985. Steedman, W.G.; Longanbach, J.R. (Battelle Columbus Labs., OH (USA)). 24 Apr 1985. Contract AC22-83PC60045. 16p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010432.

Illinois No. 6 and Wyodak coal samples were wet ground in a ball mill to >50 wt %-10 μ particle size. Several methods have been tried to directly measure the amount of ash released from the organic portion of the coal, such that it might be separated by oil agglomeration, including the use of electron microscopy and ion microprobe analysis. The results have been inconclusive. Hot-water treatment of Wyodak coal at 280 C for 30 minutes with 1% Fe/dry coal weight added as $Fe_2(SO_4)_3$ results in the removal of 90% of the calcium in the coal by ion exchange. This is the easiest known way to remove calcium, which can cause reactor plugging in the direct liquefaction of subbituminous coals by the formation of calcium carbonate deposits. Efforts to improve ash removal from Illinois No. 6 bituminous coal by oil agglomeration have resulted in the simultaneous removal of up to 55% of the non-pyritic ash while retaining 92% of the organic matter and 91 to 93% of the pyrite in the coal. The conditions may be optimized further. 4 tabs.

25192 (DOE/PC/70725—2) Use of a chemical coal binder for an advanced coal cleaning process. Quarterly report, January 1-March 31, 1985. Mulvihill, J.W. (High-Tech Services, Inc., Pittsburgh, PA (USA)). 1985. Contract FG22-84PC70725. 21p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010602.

The objective of this laboratory study is to investigate the use of a chemical coal binder for advanced fine coal cleaning technology products. Advanced fine coal cleaning technologies include OTISCA-T, froth flotation, high-gradient magnetic separation. An ultra-fine coal product that has been deep-cleaned for ash and sulfur reduction has been bonded by a proven chemical binder. A series of laboratory tests including Hardgrove grindability will be conducted on the bonded coal product. The tests will emphasize the parameters needed to properly utilize the bonded coal for various feedstocks. 2 refs., 1 fig., 6 tabs.

25193 (DOE/PC/72007—T3) Ultra-fine coal characterization. 3rd quarterly report, September 1, 1984-November 30, 1984. Smit, F.J.; Odekirk, J.R.; Hassen, M.A. (AMAX Extractive Research and Development, Inc., Golden, CO (USA)). 15 Dec 1984. Contract AC22-84PC72007. 26p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85011186.

This report covers the third quarter of activity on a 30-month project to characterize the mineral-matter liberation and the beneficiation of ultra-fine coal. So far the work has been confined to the base-case coal from Illinois No. 6 seam. Eight other coals will be examined later in the program. The work accomplished this quarter, and described in this report, includes washability tests on the minus 20- and minus 10-micrometer coal, application of automated instrument analyses to determine impurity liberation, and the initial steps of a study to characterize the hydrodynamic behavior of fine coal particles in beneficiation processes. 15 refs., 2 figs., 5 tabs.

25194 (DOE/PC/72008—T2) Development of a microwave coal cleaning process. Technical progress report, December 1984-February 1985. (TRW Energy Development Group, Redondo Beach, CA (USA)). Mar 1985. Contract AC22-84PC72008. 29p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85009912.

The objective of the program is to conduct bench scale studies to evaluate a process using microwave irradiation of caustic treated coal to remove sulfur and ash from coal. The program is organized into three tasks: equipment design and installation, shakedown testing, and process testing. This report covers and results from the design activities during the report period and includes the results from design reviews conducted by the DOE TPO and by a TRW review committee, a description of the microwave reactor, identification of the major pieces of equipment selected for pretreatment and post-treatment of the coal, and results from the performance test of candidate equipment for metering and feeding the coal/caustic mixtures to the microwave reactor. 3 tabs.

25195 **(PB—85-152890/XAB) Integration of bulk inland waterway/ocean transportation systems. Final report, 30 September 1983-30 June 1984.** (Ebasco Services, Inc., New York (USA); McMullen (John J.) Associates, Inc., New York (USA)). Sep 1984. 189p. NTIS, PC A09/MF A01.

Prepared in cooperation with McMullen (John J.) Associates, Inc., New York.

A technical and economic evaluation of coal transport from the Illinois Basin to a proposed Coal Gasification/Methanol Complex in Panama is presented. Emphasis is placed on development of transportation systems to allow increased participation of U.S. built and manned vessels in export of coal and other bulk commodities. The cost differentials favoring foreign over U.S. flag shipping are quantified, and potential methods of offsetting U.S. disadvantages are presented.

25196 **(PB—85-153872/XAB) Low-viscosity lignite slurries and suspensions. Final report, 1983-1984.** Sadler, L.Y.; Bethany, B.A. (Alabama Univ., University (USA). School of Mines and Energy Development). Oct 1984. 46p. NTIS, PC A03/MF A01.

Interest in both the transportation of coal by slurry pipeline and in the direct combustion of coal-water mixtures (CWM) has reached a high level in recent years. The development of similar technology for lignite-water slurries and suspensions is lagging far behind that of coal. This lag is primarily due the high water-to-solids ratio required of lignite-water mixtures (LWM) which are to be pumped at reasonable energy cost or which are to be used as a substitute for oil in process heating. Transportation of lignite from the mine site to the use site (either within Alabama or across the state line into Florida, for example) could be greatly facilitated if the technology developed for slurry transportation of coal could be modified so that it applied to lignite. In addition, technology that permitted the use of lignite-water suspensions as a 'liquid' fuel for power generation boilers and for process heating could also help the development of Alabama's large lignite resources.

25197 **(STEV-TORV—83-1) Influence from peat quality on the mechanical dewatering and pelletizing.** Pedersen, G. (Statens Energiverk, Stockholm (Sweden)). 1983. 20p. (In Swedish). NTIS (US Sales Only), PC A02/MF A01. File Number DE85750881.

For the tests we divided the peat into two groups. 1: Poorly decomposed peat, 2-4 on the von Post-scale. 2: Highly decomposed peat, 5-8 on the von Post-scale. The water contents is measured in a Compu-Trac humidity analyser, where the peat was dried at a temperature of not more than 105 C degrees. During the whole project we have worked with three sizes on the granulate, 4,6 and 8 mm in diameter, 10-15 cm long. The 4 mm sized granulate is hard to produce since frequent stops occurred in the extruder, due to roots and fibers from the peat. When producing the 8 mm granulate the risk for a stop was considerably reduced, but the granulate was difficult to dry completely. As a summary of the test, it shows that the 6 mm granulate probably is the most economic size The tests shows that the degree of humification is of great importance on the result of the mechanical dewatering process. Group 1 showed a water content that varied from 76 to 80 % with an average of 78 %. Group 2, with highly humificated peat, the water content was 74 % as an average. The tests showed a water content from 72-78 %. The granulate of poorly humificated peat, became porous and crumbled to bits in the transportation. The granulate from highly humificated peat was firm and stable, and it didn't show any sign of falling apart or being crushed when stored to a hight of 4 m. The peat should be mechanicaly dewatered as soon as possible after it has been excavated. This is specially important if you are dealing with highly humificated peat. In order to obtain the best result in the mechanical dewatering process, it is important that you heat the peat before pressing.(L.E.).

0140 Combustion

REFER ALSO TO CITATION(S) 25167, 25190, 25515

25198 **(ARI-RP—147) Chemical effect of entrained particles in coal conversion streams. 7th quarterly technical progress report, February 1-April 30, 1983.** Stinespring, C.; Annen, K.; Frankel, D.; Stewart, G. (Aerodyne Research. Inc., Billerica, MA (USA). Center for Chemical and Environmental Physics). 1983. Contract AC21-81MC16244. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85011789.

A major objective of the US Department of Energy is to increase coal utilization through the development of combustion stream cleanup technologies. Many of the existing cleanup devices as well as advanced concepts rely on heterogeneous processes (i.e., gas-solid interactions) to achieve efficient stream removal. Examples of such devices include particle injection and granular bed filters for alkali removal, limestone injection for SO/sub x/ removal in fluid bed combustors, dry injection for SO/sub x/ removal in entrained combustion, and trace metal adsorption and removal on fly ash. Recent studies indicate that the successful use of turbines in combined cycle processes may depend on understanding the interaction between the gas phase alkali and particles in the combustion stream to substantially reduce turbine corrosion. This report documents progress in efforts to model the heterogeneous chemistry of coal combustion streams as well as laboratory studies to obtain critical input data for the model. Appendix I has been entered separately into EDB and ERA.

25199 **(ARI-RP—147, pp A.1-A.17) Chemical effects of entrained particles in coal conversion streams: prediction of PFBC alkali levels.** Stinespring, C.D.; Annen, K.D.; Frankel, D.S.; Stewart, G.W. 1983. NTIS, PC A03/MF A01. File Number DE85011789.

In Chemical effect of entrained particles in coal conversion streams. 7th quarterly technical progress report, February 1-April 30, 1983.

The overall objective of this program is to provide the theoretical and experimental basis required to predict the levels of alkali species in PFBC systems and to analyze the effects of prototype cleanup devices. To this end, a physical model describing the partitioning of alkali species between the interior, the surface, and the gas phase surrounding particles has been developed. This model includes the processes of surface segregation, evaporation, and adsorption and may be used to calculate particle surface composition, depth profiles, average particle composition, and vaporization rates as a function of time and temperature. In addition, vaporization and segregation studies for Na and K in aluminosilicate ash and ash-like materials have been performed to provide necessary input data for the model. These experimental and theoretical results, along with input data from the Curtiss-Wright test facility, have been used to predict the levels of gas phase alkali species released from aluminosilicate ash in PFBC systems. The results of these calculations indicate that gas phase- alkali levels resulting from the aluminosilicate ash are well below those predicted by equilibrium techniques for typical PFBC operating conditions. That is, most of the alkalis associated with the ash are retained by the ash. Moreover, because of segregation processes, the surfaces of these ash particles will be enriched in alkalis (relative to the average bulk concentration). Thus, gas-surface reactions rather than gas phase reactions may be responsible for the formation of corrosive alkali-sulfur compounds. 21 refs., 13 figs.

25200 **(ARI-RP—169) Chemical effect of entrained particles in coal conversion streams. 8th and 9th quarterly technical progress report, 1 May-31 October 1983.** Stinespring, C.; Annen, K.; Frankel, D.; Stewart, G. (Aerodyne Research, Inc., Billerica, MA (USA). Center for Chemical and Environmental Physics). 1983. Contract AC21-81MC16244. 14p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85011790.

A major objective of the US Department of Energy is to increase coal utilization through the development of combustion stream cleanup technologies. Many of the existing cleanup devices as well as advanced concepts rely on heterogeneous processes (i.e. gas-solid interactions) to achieve efficient stream removal. Examples of such devices include particle injection and granular bed filters for alkali removal, limestone injection for SO/sub x/ removal in fluid bed combustors, dry injection for SO/sub x/ removal in entrained combustion, and trace metal adsorption and removal on fly ash. Recent studies indicate that the successful use of turbines in combined cycle processes may depend on understanding the interaction between the gas phase alkali and particles in the combustion stream to substantially reduce turbine corrosion. This report documents progress in efforts to model the heterogeneous chemistry of coal combustion streams as well as laboratory studies to obtain critical input data for the model. 3 refs., 1 fig.

25201 **(BMFT-FB-T—85-008) Construction and operation of a demonstration plant for the combustion of low grade waste coal in a circulating fluid bed with a capacity of 280 GJ/hour.** Wargalla, G.; Beisswenger, H. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Feb 1985. 68p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE85751609.

The circulating fluid bed combustion system is especially capable for a complete combustion of fossil fuels and to meet high environmental standards. The operation of the first demonstration plant with a capacity of 280 GJ/hour (84 MWth) has been successfully conducted. Treating high ash containing coal from the Ruhr area for combustion, more than 95% of the sulphur and 90% of the halide has been captured in the ash. The emission of other harmful impurities is very low. Therefore only less than 150 mg/NOsub(x)/Nm^3, less than 0.05 mg/Nm^3 trace elements and less than 1 mg/Nm^3 polycyclic aromatics (PAH) was emitted. The energy costs of an alumina plant have been diminished considerably, by substituting oil and high grade coal with high ash containing waste coal. The first CFB-combustion plant forms the basis for a new generation of power plants, meeting high environmental standards as well as being flexible in the use of different fuels.

25202 **(CONF-850444—2) Review of fluidized bed combustion technology in the United States.** Fox, E.C.; Krishnan, R.P.; Daw, C.S.; Jones, J.E. Jr. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 40p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85010565.

From Newer coal technologies: implications for energy and development policies in Asia and the Pacific; Honolulu, HI, USA (17 Apr 1985).

Work on fluidized bed combustion (FBC) began in the United States in the mid-1960's, with primary emphasis on industrial applications. With passage of the Clean Air Act in 1970, the environmental benefits of the technology soon attracted interest. This provided the impetus for expanded effort focused on the reduced NO/sub x/ emissions resulting from lower combustion temperature and SO_2 capture by means of chemical reaction with limestone or dolomite in the fluidized bed. The oil embargo in 1973 further stimulated interest in FBC technology. Recently interest in fuel flexibility has sustained the interest in FBC in the US. Several US manufacturers presently offer atmospheric fluidized bed combustion (AFBC) and circulating fluidized bed combustion (CFBC) units for industrial applications. However, FBC for electric power generation remains in the development and demonstration phase. The Tennessee Valley Authority (TVA) and Electric Power Research Institute (EPRI) are operating a 20-MW(e) AFBC utility pilot plant and are proceeding with plans for a 160-MW(e) demonstration plant with other participants. Research on pressurized fluidized bed combustion (PFBC) has been under way at Grimethorpe in South Yorkshire, England, at the Curtiss-Wright Pilot Plant in the US, and at other smaller test facilities. An emerging turbocharged PFBC concept will likely stimulate more near-term interest in PFBC technology for both industrial and utility applications. The major US programs and test facilities are described herein. The remaining technical uncertainties and the future outlook for the technology are also discussed. 39 refs.

25203 **(CONF-8205275—) Potential applications of fluidized bed combustion in Canadian industry: proceedings.** (Canadian Inst. of Energy; Canada Centre for Mineral and Energy Technology, Ottawa, Ontario). 1982. 182p. NTIS (US Sales Only), PC A09/MF A01. File Number DE84901602.

From Meeting on potential applications of fluidized bed combustion in Canadian industry; Calgary, Canada (27 May 1982).

The purpose of this seminar was to present an overview of current technology in Atmospheric Fluidized Bed Combustion in Canada, Japan and the United States, and to outline and encourage potential applications of this technology in Canadian industry. All six papers have been processed for inclusion in the Energy Data Base.

25204 **(DOE/FE/60339—T12) Use of fluidized bed coal combustion techniques to study efficiency, emission reduction, boiler effects, and waste utilization. Final report, July 1, 1983-December 31, 1984.** Hesketh, H.E.; Rajan, S.; Miyasaka, K. (Southern Illinois Univ., Carbondale (USA). Coal Extraction and Utilization Research Center). Mar 1985. Contract FC22-83FE60339. 54p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85010077.

Both standard reference coals and waste gob pile coals have been burned in a bench scale 9 cm diameter fluidized bed combustor. The influence of particle size, fluidization velocity, bed temperature, and calcium/sulfur (Ca/S) mole ratio has been investigated. Studies with the reference coals indicate that the sulfur forms present in the coal influence the formation of sulfur dioxide and its subsequent capture by the limestone. Combustion and emissions characteristics of the gob coal are shown to be influenced by a variety of factors, including bed temperature, superficial velocity, and Ca/S mole ratio. In addition, a 16-inch diameter atmospheric fluidized bed combustor was constructed at the Coal Technology Laboratory. The information generated by the bench scale studies will be used in the design of experiments to be performed on the pilot scale unit. 7 refs., 12 figs., 2 tabs.

25205 **(DOE/MC/19326—1699) Advanced atmospheric fluidized-bed combustion design. Final report.** Rudnicki, M.I.; Jassowski, D.M.; Mah, C.S.; Newton, R.A. (Aerojet Energy Conversion Co., Sacramento, CA (USA)). Jan 1985. Contract AC21-82MC19326. 252p. NTIS, PC A12/MF A01; 1; GPO Dep. File Number DE85001991.

In the process of the design study, the UAFBC system configuration has been evolved and simplified. The system combines a self-cleaning distributor/grate section (which can tolerate large coal particles) with a fluidized bed. Proper control of the distributor/grate and fluidized-bed provides high turndown capability. For maximum carbon utilization, an afterburner is provided. NO/sub x/ control is achieved by proper combustion staging and temperature control. For SO/sub x/ control, an entrained-bed sulfur scrubber, which uses small sorbent particles and long solids stay times yields efficient sulfur capture with a low calcium/sulfur ratio. The Aerojet design approach is to provide enough functional separation in the system to allow the stringent design goals to be satisfied compatibly. Various known state-of-the-art subsystems - self cleaning distributor/grate, fluidized-bed combustor, fines afterburner, entrained-bed dry scrubber - have been integrated to make this possible. The coordinated operation of the system elements is accomplished through the use of modern microprocessor controls. In this way, close control is obtained over the mechanisms of the combustion, sulfur scrubbing and particle cleanup processes without undue complexity. This high degree of process control permits development of a combustor which should exceed present environmental standards for NO/sub x/, SO/sub x/, and particulates, while allowing operation with an 8:1 turndown using a wide variety of fuels. In the design study, a number of configurations were considered and analyzed by computer simulation. Performance projections

were made for various power levels and, in the case of the bench-scale system, for three different coal feeds. Greer limestone (75 wt % $CaCO_3$) was used as the reference sulfur sorbent. The results showed potentials for rapid commercialization of small (50,000 lb/h steam) UAFBC systems. 56 refs, 79 figs., 35 tabs.

25206 **(DOE/MI/10024—T1) Advanced atmospheric fluidized-bed combustion design: the staged cascading fluidized-bed combustor.** (Howard Univ., Washington, DC (USA); Energy and Environmental Engineering, Inc., East Cambridge, MA (USA)). 19 Feb 1985. Contract FC01-83MI10024. 94p. NTIS, PC A05; 3; GPO Dep. File Number DE85006908.

The distinctive features of the Staged Cascade Fluidized Bed Combustor (SCFBC) are: combustion is accomplished in two cascaded fluidized beds, with coal fed between the beds; sulfation occurs in two cascaded fluidized beds with the spent sorbent being reactivated between the beds; all heat exchange tubes are submerged in a series of cascaded fluidized beds to improve heat transfer efficiency; the lowest stage provides cooling of spent bed materials and preheating of incoming air; and all of the fluidized beds are shallow, roughly 4" to 8" expanded bed depth. The SCFBC does not require external convective section, economizer, air preheater, or spent solids cooling system, as does the AFBC. All the functions of those traditional components are performed within the SCFBC. The shallow beds and low pressure drop distributor plates of the SCFBC have cumulative pressure drop essentially equal to the pressure drop across the single deep bed of a conventional AFBC. Better fuel utilization is achieved in the SCFBC, which achieves a carbon burnout of 97.1% vs 95.0% for the AFBC. The SCFBC advantage is due to the staging of combustion in two beds. The thermal efficiency of the SCFBC is higher than that of the AFBC (85.4%) vs 31.65%). The SCFBC accomplishes the specified SO removal with a significantly reduced amount of limestone adsorbent. The SCFBC has several other technical advantages over the AFBC which are mentioned. 11 figs., 23 tabs.

25207 **(DOE/PC/50270—T2) Coal water mixture development. Quarterly technical progress report. Draft.** (TRW, Inc., Redondo Beach, CA (USA)). 13 Jan 1983. Contract AC22-82PC50270. 21p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004141.

The Plant Equipment and Performance task of the Coal Water Mixture Development program has been underway for three months. During that time TRW has planned and scheduled a 36 month program which will meet the goals and objectives of the project. Through the design, construction and operation of subscale test plant simulating the fuel feed system to industrial and utility boilers, a data base will be generated which will allow industrial users to develop designs for full scale boiler installations. The preliminary design and equipment selection for the test plant is now underway. Data and operating requirements for the plant have been developed. Several conceptual designs have been generated and evaluated. Contacts have been made with suppliers of instruments and equipment as part of the selection process. TRW's subcontractor, Stone and Webster, is now under contract and working toward the development of an equipment list and a P & ID for the test plant. Initial estimates of the quantities of CWM required for the test operations have been completed. Second quarter plans include the continuation and completion of the preliminary design effort and the selection of equipment and instrumentation. 2 figs., 5 tabs.

25208 **(DOE/PC/50270—T3) Coal water mixture development. Quarterly technical progress report.** (TRW, Inc., Redondo Beach, CA (USA)). 13 Jan 1984. Contract AC22-82PC50270. 16p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85004142.

The project addresses the selection and performance of front end boiler equipment using coal water mixtures (CWM) for the design of new installations or retrofits of existing oil fired boilers. The project objectives are to develop an industry acceptable engineering data base for the selection of equipment and instruments in CWM service and to further understand the hydraulic behavior, physical properties and rheological properties of the CWM's. The project will accomplish its goals in a 36 month program through the collection, reduction, assessment and correlation of data obtained from evaluations performed in subscale test loops simulating in-plant CWM feed systems. The small scale testing and data correlation offers the most cost effective method of evaluating the performance of equipment, instrumentation and piping components, and the development of a hydraulics data base. During this past quarter installation of the test loops has been 85% completed. It is planned to install the remaining items by the end of January and initiate checkout and shakedown in February.

25209 **(DOE/PC/50270—T4) Coal water mixture development. Quarterly technical progress report.** (TRW, Inc., Redondo Beach, CA (USA)). 7 Oct 1983. Contract AC22-82PC50270. 11p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85004143.

All equipment, instruments and materials for the test loops have been ordered. A number of pieces of equipment have been received and mounted into position. Current plans call for completion of construction of the coal water mixture test loops in early December with checkout to begin shortly thereafter. It is estimated that at least 28,000 gallons of CWM is needed for operation of the test loop during the course of the project.

25210 **(DOE/PC/50270—T5) Coal water mixture development. Quarterly technical progress report.** (TRW, Inc., Redondo Beach, CA (USA)). 1 Jul 1983. Contract AC22-82PC50270. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85004140.

The plant equipment and performance project of the Department of Energy Coal Water Mixture Development Program has been underway for nine months. During the last quarter a preliminary design package for simulation of the fuel feed system to industrial and utility boilers was prepared. The design document contained system requirements, piping and instrumentation drawings, equipment specifications, instrumentation specifications, piping and components specifications and information on fabrication, installation and checkout of the test loop. The document was reviewed by the Department of Energy and assembled contractors and subcontractors in the Coal Water Mixture Development Program at the end of April. The final design package, incorporating suggestings made at the preliminary design review, was completed in June and reviewed by the subcontractors, Stone and Webster and Adelphi University. Concurrence was obtained from the Department of Energy on the final design package and equipment list, and purchasing of the equipment, instrumentation materials was authorized. Requests for formal quotations on all major equipment items have been issued. Quotes on all pumps and on the heat exchanger have been received and are in evaluation. Plans for the next quarter include obtaining quotes and placing purchase orders for the remaining equipment items and instruments. Equipment deliveries will begin in August. Installation of the test loops will begin with preparation of pump pads, pipe supports, relocation of electrical lines and prefabrication of piping runs as well as installation of some piping and major equipment. Draft test matrices will be prepared for operation of the test loop and the data acquisition system will be specified.

25211 **(DOE/PC/70770—3) Fundamental studies of the mechanisms of slag deposit formation.** Austin, L.G.; Tangsathitkulchai, M.; Gomez, C.; Malchenson, D.; Benson, S. (Pennsylvania State Univ., University Park (USA). Coll. of Earth and Mineral Sciences). [1985]. Contract FG22-84PC70770. 34p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85009350.

A laboratory drop-tube furnace was used to investigate slagging tendencies of pulverized coal under conditions which simulate the combustion conditions in a full-scale utility boiler. The accomplishments include: (1) a newly pulverized coal feed system designed to produce a primary air-pulverized coal stream was tested. The feed rate can be varied from approximately 0.1 to 1 gram/minute. A forty minute test was conducted at a feed rate of 0.33 g/minute and gave a standard deviation of feed rate of 0.04 g/minute; (2) the growth rate of deposits with time was shown to be a function of the type of coal. Sticking coefficients were determined to emphasize the differences exhibited by various selected coals during the growth of deposits; and (3) mounting and cross-sectioning of

deposits allowed detailed SEM/x-ray fluorescence analysis to determine chemical and morphological characterizations. Developmental work continued on the computer-controlled SEM system. A multichannel x-ray analyzer was interfaced with the SEM system in addition to the single channel analyzer used previously. This unit adds increased flexibility over the single channel analyzer, since it allows the analysis of more elements when the system is used as a manual electron microprobe. The sintering characteristics of a North Dakota fly ash were tested. Preliminary results suggest that the crystalline properties of the sinter products are a significant factor in developing the sintered strength of the fly ash. 13 refs.

25212 **(DOE/PC/70794—2) Effect of energy feedback mechanisms on the oxidation rate of pulverized coal. Quarterly report, December 1, 1984-February 28, 1985.** Choi, S.; Haussmann, G.; Kruger, C.H. (Stanford Univ., CA (USA). High Temperature Gasdynamics Lab.). Mar 1985. Contract FG22-84PC70794. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85010024.

This research program has as its objective the understanding of energy feedback from burning volatiles surrounding pulverized coal particles as a fundamental mechanism of coal oxidation, and the assessment of the applicability and limitations of this mechanism for varying coal combustion environments. Three reactor tests have been performed in which oxidation reactivities were measured and newly developed diagnostics were implemented. Along with tests performed during the previous period, a complete test sequence has been completed where the major reaction variables (gas temperature, oxygen concentration, and particle size) have been parametrically studied. Results are summarized in Chapter 3 of this report, and interpretation and discussion is found in Chapter 4. 19 refs., 18 figs.

25213 **(DOE/PC/70815—T3) Kinetic of coal combustion. Quarterly report.** Fairchild, P.; Flagan, R.C.; Essenhigh, R.H.; Gat, N. (TRW Space and Technology Group, Redondo Beach, CA (USA)). Apr 1985. Contract AC22-84PC70815. 31p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85011511.

Planned experiments involve the combustion of volatile matter (obtained by pyrolysis) and of chars. The initial work is being done with propane. (LTN)

25214 **(STEV-FBA—84-4) Final report from the demonstration project for COM-combustion at Upplands Vaesby.** Erdegren, T. (Statens Energiverk, Stockholm (Sweden)). Nov 1983. 72p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. File Number DE85750883.

Demonstration test of COM-combustion in a district heating plant at Upplands-Vaesby, Sweden are reported. 466 tons of 60/40 and 50/50 coal/oil mixtures produced by Nycol, Stora Vika were consumed during the tests. Total operation time was 420 hours. A 23 MW fuel oil boilers was converted for COM firing. COM firing was performed at 6-15 MW. The boiler efficiency varied between 80 and 86 %, with main contribution from flue gas losses; only 1-2 % of the fuel was unburnt. The oil burner operated well on the COM fuel, no tendencies to wear were noted. Problems arose due to pressure variations in the COM fuel before the burner, but rapid and slow pressure variations were noted. The rapid variations disappeared with the charge from 60/40 to 50/50 coal/oil mixture. The fuel had an acceptable stability during the tests. Some effects of sedimentation and bleeding were however noted. The emission of particles was much higher, NOx higher and SO_2 unchanged, compared to oil firing. Estimates of the economy of the COM conversion are presented in the report.(G.B.).

25215 **(STEV-FBA—84-10) Experimental investigation of the combustion and burnout of two different coals.** Gromulski, J. (Statens Energiverk, Stockholm (Sweden)). Sep 1983. 51p. (STUDSVIK-EB—83-128). NTIS (US Sales Only), PC A04/MF A01. File Number DE85750895.

The physical and chemical behaviour of two types of pulverized coal, one Polish and one Australian, during combustion are compared in a 4 MW furnace and a drop tube furnace (DTF). The drop tube furnace experiment shows that the rate of combustion is controlled to a substantial degree by the rate of chemical reaction for Australian coal. For Polish coal, as reaction rates increase the rate becomes controlled by the combined effects of chemical reaction and pore diffusion. The differences in burnout for Polish coal curves in the experimental and DTF furnaces are explained in terms of diffusion and chemical reaction rates. The temperature coefficient of the reaction corresponded to a global activation energy of about 14 kcal/mole for Australian coal and 15 kcal/mole for Polish coal.

25216 **(STEV-FBA—84-11) Combustion of five different coal species in a drop tube furnace.** Gromulski, J. (Statens Energiverk, Stockholm (Sweden)). 1984. 71p. (In Swedish). (STUDSVIK-EB—83-136). NTIS (US Sales Only), PC A04/MF A01. File Number DE85750896.

The theory of the combustion of pulverized coal is described. The burnout of five coals at the temperature of 800 to 1200 degreeC has been studied. The species were Illinois 6B, Hunter Valley and three Polish coals. The reaction kinetics of coal can be characterized by the Arrhenius dependence. The activation energy and the pre-exponential factor have been experimentally determined for the five species and their practical significance is discussed.

0150 Marketing And Economics

REFER ALSO TO CITATION(S) 25105, 25136, 25183, 25233, 25513, 25782

25217 **(PB—85-160927/XAB) Technology, productivity, and labor in the bituminous coal industry, 1950-1979. Final report.** Zeisel, R.N.; Dymmel, M.; Falwell, G.E. (Bureau of Labor Statistics, Washington, DC (USA)). Feb 1981. 79p. (BLS-Bull—2072). NTIS, PC A05/MF A01.

Library of Congress Calalog Card No. 80-607858.

A chartbook appraising technological changes in the bituminous coal industry. Updates BLS Bulletin 1305, Technological Change and Productivity in the Bituminous Coal Industry, 1920-60.

25218 **Prospects for world coal trade 1984 to 1995.** Tukenmez, E. (Energy Information Administration, US Dept. of Energy, Washington, DC). pp 65-72 of Coal Technology '84: Book I. Houston, TX; Industrial Presentations Inc. (1984). (CONF-841102—).

From 7. international coal utilization conference and exhibition; Houston, TX, USA (13 Nov 1984).

Future developments in the world coal market will have a major impact on U.S. coal exports. This presentation summarizes Energy Information Administration (EIA) projections for U.S. coal exports and world coal trade over the next ten years. The EIA, an independent agency within the Department of Energy, was established by Congress in 1977 to "collect, evaluate, assemble, analyze, and disseminate (energy) data and information." In order to exercise that Congressional mandate, EIA maintains the most extensive and efficient energy information gathering, maintenance, and analysis system in the United States--and perhaps in the world. Virtually all of EIA's information, including our analytical methodology, is accessible to the public, industry, and the government. EIA employs an in-house staff of about 500 people, whose expertise is relied upon by the Executive Branch, Congress, and decision-makers throughout the energy industries. The Data Analysis and Forecasting Branch of EIA's Coal Division, is specifically responsible for providing objective, accurate, and timely studies of the U.S. coal industry and its place in the world coal market. EIA maintains the International Coal Trade Model (ICTM) to assess the consequences of many issues that relate to U.S. coal exports and world coal trade. The ICTM is currently used to generate projections for the years 1990 and 1995. These projections are updated each year in EIA's Annual Energy Outlook and reflect a set of assumptions regarding the world oil price, economic growth, and the supply capabilities of individual coal-exporting countries.

25219 **EIA'S export market approach and outlook.** Hickman, J.G. (Dept. of Energy). *Coal Technology;* **1**: 21-34(Nov 1983). (CONF-831112—).

From Coal technology '83 - international coal utilization convention; Houston, TX, USA (15 Nov 1983).

The Energy Information Administration is an independent agency within the Department of Energy. It was established by Congress in 1977 to "collect, evaluate, assemble, analyze, and disseminate (energy) data and information." In order to exercise that Congressional mandate, EIA maintains the most extensive and efficient energy information gathering, maintenance, and analysis system in the United States--and perhaps in the world. Virtually all of EIA's information is accessible to the public, industry, and government. EIA employs an in-house staff of about 490, whose expertise is relied upon by Congress and by decision-makers throughout the energy industries. We, in the Data Analysis and Forecasting Branch of EIA's Coal Division, are specifically responsible for providing objective, accurate, and timely studies of the United States' coal industry and its place in the world coal market. Annual U.S. coal exports averaged 48.2 million tons during the 1960's--about 3 1/2 million tons below the average level for the 50's. But coal exports began growing again in 1969. Through the early and mid 1970's, U.S. coal exports grew at an average annual rate of about 3.5 percent. Then, in 1978, total U.S. coal exports dropped to the lowest level since 1961, as export coal was diverted to domestic use during the prolonged 1977-78 coal miner's strike. The United States is regarded as the marginal coal supplier in the world market due to its high production and transportation costs. Nonetheless, the U.S. was then (and still is) the world leader in coal exports.

0160 Health And Safety

REFER ALSO TO CITATION(S) 26196, 26214

25220 (DOE/MC/12048—1731) Effects of coal combustion effluent on pulmonary carcinogen metabolism. Colby, H.D. (West Virginia Univ., Morgantown (USA). Dept. of Physiology). Oct 1983. Contract AT21-79MC12048. 30p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85003362.

The results of a multi-year Coal Toxicology Program are summarized. The focus of the investigations was on the effects of heavy metals found in coal combustion effluent on the metabolism of carcinogens and other xenobiotics by lung and other tissue. 3 figs., 17 tabs.

25221 (KHM-TR—88) Health hazards due to coal dust in places of work and environment. Svensson, E.; Hogstedt, C. (Statens Vattenfallsverk, Vaellingby (Sweden). Projekt KOL-HAELSA-MILJOE). May 1983. 49p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. File Number DE85750875.

Coal dust can arise from mining, loading, transport, unloading and storing of coal. The inhaled dust deposited in different places in the airways and lungs. The airways and lungs are mainly affected by a simple coal workers pneumoconiosis, CWP. The larger the cumulative exposure to coal dust the greater the risk of developing CWP. Smoking does not seem to play a major role in the origin of CWP. In certain individuals a CWP may develop into more complicated form of pneumoconiosis, a so called Progressive Massive Fibrosis, PMF. PMF depends, as does CWP, on the total amount of respired coal dust. Contrary to CWP however, once the process has started it does not stop even if the exposure to coal dust is discontinued. Individuals exposed to coal dust may also be affected by chronic obstructive diseases like empysema and bronchitis. Exposure to coal dust does not seem to be associated with an increased risk for lung cancer in large epidemiological studies. A higher mortality in cancer of the stomach than expected has been found both in Great-Britain and USA. The reason for this is unknown. Stomach cancer seems to be correlated with the total amount of respirable coal dust inhaled. For other cancers consistent differences in frequency between individuals exposed to coal dust and others have not been reported. Considering health standards hygienic effect must be calculated from health standard values of coal-dust, quartz and other materials in the respirable dust. Working in a modern coalfired power station and electricity plant probably inflicts an insignificant health hazards due to coal dust. In order to discover potential early signs of negative effects health check-ups with chest X-ray, lung function tests and a questionnaire on respiratory and other symptoms.

0170 Legislation And Regulations

REFER ALSO TO CITATION(S) 25175

02 PETROLEUM

0202 Geology And Exploration

REFER ALSO TO CITATION(S) 25224, 25490

0203 Drilling And Production

REFER ALSO TO CITATION(S) 25240, 25828, 25852, 25967

25222 (DOE/ER/10967—T1) [Mathematics of oil production]. Final report. Jeffrey, A.; Gilbert, R.P. (Delaware Univ., Newark (USA). Applied Mathematics Inst.). 1984. Contract AC01-81ER10967. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85011235.

Research undertaken covered the following: (1) oil recovery which included in situ combustion, hot water drive, mathematical model for percolation involving pore microstructure, gas flows with heat release and shock waves, wave propagation in a viscous heat conducting gas, and moving boundary problems; (2) general seismic problems - modeling which involved wave propagation in nonlinear viscoelastic media, general behavior of acceleration waves in nonlinear media, propagation of acceleration waves in a layered rod of variable cross section, and propagation of acceleration waves in an arbitrary layered region; and (3) general elastic properties of solids (orthotropic plates and anomalous wave propagation in nonlinear elastic solids. 17 refs.

25223 (DOE/RG/10494—T1) Characteristics of the deviation of lease production from allowable in Hawkins Field. (Pennsylvania Univ., Philadelphia (USA)). 14 Jun 1983. Contract AC01-81RG10494. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85011149.

This paper summarizes several aspects of the lease-to-lease deviation of petroleum production from the lease allowables. The data which yield these results are the monthly production and allowable data for 203 leases in Hawkins Field, Texas, for which complete data is available over the analysis period, the 65 months from January 1970, through May 1975, inclusive. The third series M(m) is the maximum monthly deviation of lease production from allowable. Thus the series M(m) gives the value of the largest lease over-production relative to allowable in month m. From inspection of Figure 4, the series is fairly stable up to January 1975, at which point it rapidly increases to a value several times larger than the prior largest observed value. As is visually evident from the figures, all three series abruptly change in January 1975, relative to their behavior in the preceding five years. Using this preceding period to establish a baseline of stochastic behavior, standard autoregressive, time-series models confirm the visual impression. The last five months do not conform to the pattern established in the prior years. Assuming the common Gaussian error structure, approximate p-values associated a test of the hypothesis of no change are less than 0.001. 3 figs., 1 tab.

25224 (NMERDI—2-71-4333) Steamflood pilots in the O'Connell Ranch field and the T-4 Ranch field. Final report. Martin, F.D. (New Mexico Inst. of Mining and Technology, Socorro (USA). New Mexico Petroleum Recovery Research Center). Apr 1985. 101p. NTIS, PC A06/MF A01 - NMERDI-Information Center, Univ. of New Mexico, 117 Richmond Dr., N.E., Albuquerque, NM 87106. File Number DE85901363.

This report contains field results and geological information on two small steamflood projects in Guadalupe County, New Mexico. Both projects, the O'Connell Ranch and T-4 Ranch Pilots, were operated by Rio Petro, Dallas, TX. Water injection rates at these pilots were low and intermittent. Since the oil sands are relatively thin, heat was lost to adjacent rock, and no substantial tem-

perature increase in produced fluids has been observed. Through September 1984, the O'Connell Ranch Pilot produced 337 barrels of oil; no oil was produced at the T-4 Ranch Pilot. Three developmental techniques are suggested for use in these projects, and each is being considered. 24 refs., 55 figs., 2 tabs.

25225 **(PB—85-128858) Control of blowout fires with water sprays. Final report.** Evans, D.D. (National Bureau of Standards, Washington, DC (USA)). 1984. 7p. Pub. in Proceedings of Technology Assessment and Research Program for Offshore Minerals Operations, Reston, VA, March 28-29, 1984, p89-95.

Sponsored in part by Minerals Management Service, Reston, VA.

An overview of the fire suppression research studies directed at understanding the effects of water spray on hydrocarbon fires is presented. Fire protection system design concepts for the protection of offshore oil and gas platforms in the event of a blowout fire are discussed.

25226 **Y267 EPDM elastomer in hydrocarbons important and unexpected very high temperature case histories.** Hirasuna, A.R.; Friese, G.J.; Stephens, C.A. (L'Grade Inc., Newport Beach, CA). pp 40 of Corrosion '84. Houston, TX; NACE (Apr 1984). (CONF-840405—).

From NACE corrosion '84 international forum and exhibition; New Orleans, LA, USA (1 Apr 1984).

Y267 EPDM was recently developed for aqueous geothermal seal applications. The compound has proven successful operating at temperatures in excess of 316C (600F), differential pressures over 69 MPa (10,000 psi), and for multiple exposures before changing the seals. The technology was transferred to three American firms and parts are currently commercially available from them. The data are indicating that the cardinal rule against using EPDMs in hydrocarbon applications may be invalid. Significant data are presented illustrating Y267 EPDM technology to be a viable candidate for hostile hydrocarbon service. The data show viable candidacy to the extreme worst case end of the spectrum, i.e., highly aromatic hydrocarbons. Several case histories are provided. The paper also discusses how immersion tests can be highly misleading, and that swell can really be a friend rather than a foe.

0204 Processing

REFER ALSO TO CITATION(S) 25134, 25877, 25890

25227 **Synthesis gas conversion in a mixed slurry reactor with iron-manganese catalysts.** Pennline, H.W.; Schehl, R.R.; Tischer, R.E.; Zarochak, M.F. (U.S. Dept. of Energy, Pittsburgh, PA). *AIChE National Meeting;* No. 14C, 25(Aug 1984). (CONF-840828—).

From International synfuels policies and technologies symposium; Philadelphia, PA, USA (19 Aug 1984).

Synthesis gas was reacted over different compositions of iron-manganese Fischer-Tropsch catalysts in a slurry reactor. The reactor operates in a back-mixed mode with a continuous flow of feed gas through the catalyst suspended in the liquid medium. Four catalysts with iron-manganese ratios of 57/43, 44/56, 22/78, and 10/90 were investigated at identical process conditions after a standard activation procedure. With time on stream for each catalyst system, hydrogenation of olefins occurred, along with olefin isomerization reactions. Activity, selectivity, and stability are discussed in general. Analyses of used catalyst samples are also reported.

0205 Products And By-products

REFER ALSO TO CITATION(S) 25241

25228 **(AD-A—150336/6/XAB) Some characteristics of automotive gasolines and their performance in a light aircraft engine. Final report, October 1982-March 1984.** Morrison, K.M.; Sung, N.W.; Patterson, D.J. (Michigan Univ., Ann Arbor (USA). Dept. of Mechanical Engineering). Nov 1984. 101p. NTIS, PC A06/MF A01.

The primary purpose of this extensive test effort was to observe real-time operational performance characteristics associated with automotive-grade fuel utilized by piston-engine-powered light general-aviation aircraft. In fulfillment of this effort, baseline engine operations were established with 100LL aviation grade fuel followed by four blends of automotive-grade fuel. A comprehensive sea-level static test cell/flight test data collection and evaluation effort was conducted to review operational characteristics of a carbureted light-aircraft piston engine as related to fuel volatility, fuel temperature, and fuel-system pressure. Sea-level static test cell engines operations were conducted utilizing an AVCO Lycoming 0-320 engine connected to an eddy-current dynamometer which facilitated data collection under various engine load conditions. In addition, real-time inflight performance data was obtained utilizing a Cessna 150/Continental 0-200A engine, while operating on test fuels No. 1 and No. 2 which had Reid vapor pressures of 14.4 psi and 8.0 psi, respectively.

25229 **(AD-A—150796/1/XAB) JP-8 and JP-5 as compression-ignition engine fuel. Interim report, July-December 1984.** Bowden, J.N.; Owens, E.C.; LePera, M.E. (Southwest Research Inst., San Antonio, TX (USA)). 15 Jan 1985. 35p. NTIS, PC A03/MF A01.

For many years, aircraft turbine fuel JP-5 has been used in diesel-engines as an alternate fuel for DF-2, and is listed as such in Army Regulation 703-1. Since 1965, diesel engine endurance tests have been conducted in a variety of compression-ignition engines using JP-5 or JP-8 as the fuel and comparing performances with DF-2. None of these tests showed engine failures or excessive wear attributable to the use of kerosene-type aircraft turbine fuels, although slightly reduced fuel-injection delivery volumes and lower power output were experienced in most engines, due to lower viscosity and lower heat content of JP-5 and JP-8 compared to DF-2. These results notwithstanding, periodically, concerns are raised about the use of JP-5 and JP-8 in diesel engines over long periods in the 500- to 1000-hour time frame, especially in new engine designs. This report is primarily an annotated bibliography of 23 references consisting of technical notes, letters, letter reports, and interim reports, on the subject of using aircraft turbine fuels JP-5 and JP-8 in diesel engines.

25230 **(AD-A—150825/8/XAB) Aircraft wing fuel tank environmental simulator tests for evaluation of antimisting fuels. Final report, September 1982-August 1984.** McConnell, P.M.; Tolle, F.F.; Mehta, H.K. (Boeing Military Airplane Co., Seattle, WA (USA)). Oct 1984. 110p. NTIS, PC A06/MF A01.

The low-temperature performance of antimisting kerosene (AMK) in airframe fuel systems and in certain fuel system components was studied and compared to Jet A fuel. Water vapor ingested into fuel tanks during simulation of repeated descents through clouds and rain had little effect on AMK. AMK retained antimisting properties during exposure to severe environmental flight simulations. Jet-pump and boost-pump operation had no discernible effect on AMK flammability. Jet-pump performance with AMK was adversely affected. Main fuel boost pumps required up to 18% more power with AMK that with Jet A, and suction-feed performance was lower with ambient and -20°C, but better than Jet A and -40°C. Boost-pump performance was not affected by gel formations produced at low temperatures by the vapor-removal return flow shearing of AMK. Aerodynamic heating and cooling of AMK in the fuel tank was similar to Jet A. A high-pressure pump and needle valve used to degrade the AMK was inadequate, resulting in filter bypass at low temperatures.

25231 **(PB—85-154284/XAB) Thermal radiation hazards from LPG fireballs.** Partanen, J.P.; Vuorio, M. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). [1985]. 32p. NTIS, PC E04/MF E01.

Turbulently burning fuel-rich fireballs cool both by thermal radiation and by mixing with ambient cold air. Both mechanisms have been considered important. In this work the authors first study their relative effectiveness by re-analyzing published, small-scale experimental results and by two simple analytical models, which take into account only one of the cooling mechanisms at a

time. The models indicate that mixing dominates over radiation. Detailed analytical calculations of thermal radiation are prohibitively complicated due to the fact that the temperature of the fireball, including its effective surface temperature, can not be determined by averaging in spite of the strong turbulence present. However, using some plausible assumptions the authors were able to extrapolate the empirical, thermally radiating fraction of the energy from experimentally available fireball sizes to such larger masses that are relevant in industrial accidents. This is done by scaling the relevant parameters (fireball radius, its burning and cooling time) with the released fuel mass M(sub f). The radiating fraction turns out to be a weakly decreasing function of the mass (about M(sub f) to the -1/6th power). In the end we estimate the health hazards from thermal radiation to people at different distances as a function of M(sub f).

0206 Health And Safety

REFER ALSO TO CITATION(S) 25225

0207 Marketing And Economics

25232 (DOE/EI/10314—T1) Heating oil supply/price monitoring report. Part I. Historic data, August 1978-July 1979; Part II. Current data, August 1979-May 1980. (Maine Office of Energy Resources, Augusta (USA)). Aug 1980. Contract FG01-81EI10314. 49p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85009853.

The 1973-1974 oil embargo brought national realization to the importance, and need for the collection and analysis of energy data. The Maine Office of Energy Resources (OER) is responsible for the establishment and implementation of energy plans and policies in the State of Maine. The Supply/Price Monitoring System has been created to assist energy planners both in Maine and the nation. This survey is used to analyze trends in home heating oil supply and price, and as a tool in responding to inquiries from: citizens, other state agencies, federal and local offices, and the Office of the Governor. This report will describe the Supply/Price Monitoring System, and the results obtained from the survey, during the period August 1, 1979 through May 31, 1980. Historical data are also provided as required by the aforementioned agreement between the OER and the US Department of Energy.

25233 (DOE/EIA—0202(85/2Q)) Short-Term Energy Outlook. Quarterly projections, April 1985. (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). May 1985. 49p. NTIS, PC A03/MF A01; 1 - GPO; GPO Dep. File Number DE85011693.

The Energy Information Administration's (EIA) quarterly forecasts of energy supply, demand, and prices are presented through the first half of 1986. The forecasts are produced using the Short-Term Integrated Forecasting System (STIFS). The STIFS model uses two principal driving variables, a macroeconomic forecast and the world oil price assumptions. Three projections are given for petroleum supply and demand, based on low, medium, and high economic growth scenarios that incorporate low, medium, and high crude oil price trajectories. Other discussions on energy product prices and supply and disposition of gasoline, distillate fuel oil, residual fuel oil, natural gas, coal, and electricity are based on the medium scenarios. Other cases examine the sensitivity of total petroleum demand to varying assumptions about prices, weather, and economic activity. 7 figs., 17 tabs.

25234 (DOE/EIA—0380(85/02)) Petroleum Marketing Monthly, February 1985. (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). Apr 1985. 161p. NTIS, PC A08/MF A01; 1 - GPO; GPO Dep. File Number DE85011278.

Petroleum product marketing data are reported for the United States, Petroleum Administration for Defense (PAD) Districts, and each of the 50 states for the current and previous month of 1985 and for a corresponding month in 1984. Some data are also summarized for each year from 1978 through 1984. Shown for individual petroleum products are sales prices, sales volumes, percentages of sales, and first sales for consumption. Data are given by type of seller (major refiners and other refiners/gas plant operators) and by type of sale (sales to end users and sales for resale). Data for the current month are preliminary. The collection methodology is described in the explanatory notes. A glossary is included. Title of the feature article is "Petroleum Marketing Monthly Initiates Crude Oil Data Series". 17 fig., 75 tabs.

25235 (OCS/MMS—84-0075) Outer continental shelf oil and gas activities in the Pacific and their onshore impacts. Pacific summary report. Havran, K.J.; Lynch, C.W. (Rogers, Golden and Halpern, Inc., Reston, VA (USA)). Jul 1984. 127p. OCS Information Program, Office of Offshore Information Services, Minerals Management Service, 12203 Sunrise Valley Dr., MS 640, Reston, VA 22091. File Number TI85901419.

Three lease sales off the coast of California remain on the Department of the Interior's 5-year Outer Continental Shelf oil-and-gas leasing schedule. Interior's policy of conducting areawide lease sales will continue, but the program will undergo some modifications. Geologically, the Pacific region offers good potential for further hydrocarbon discovery. The southern Santa Maria Basin and the Santa Barbara Channel command industry's current interest and exploration efforts. Production of oil and gas in the Pacific Outer Continental Shelf Region continues to rise at a strong pace; in 1983, oil was produced at a rate of approximately 83,000 barrels per day. The tenth oil-and-gas lease sale in the Pacific Outer Continental Shelf Region, Lease Sale 73, was held on November 30, 1983. Off central California, 137 tracts were offered and 8 were leased. With conclusion of this lease sale, there are presently 192 active leases in federal waters off the coast of California covering a total of 1,013,386 acres. Three future lease sales are planned in the region through June 1987. Much of the Pacific Outer Continental Shelf development has occurred and will continue to occur off the coast of Santa Barbara County. In an effort to mitigate potential negative impacts accruing onshore from increased offshore industrial activities, the county has drafted an Oil Transportation Plan. Preliminary conclusions of this long-range, comprehensive study include a preference for the shipment of oil by pipeline over shipment by tanker or train; an allowance for the use of tankers on an interim basis; and a belief that offshore operators should consolidate their onshore facilities to the greatest extent possible. 24 refs., 11 figs., 8 tabs.

0208 Waste Management

REFER ALSO TO CITATION(S) 25170

25236 (NP—5770277) Contributions to supercritical gas extraction of petroleum residues. Lutz, U. (Technische Univ. Clausthal, Clausthal-Zellerfeld (Germany, F.R.). Fakultaet fuer Bergbau, Huettenwesen und Maschinenwesen). 1 Feb 1984. 127p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85770277.

The phase behaviour during supercritical extraction of petroleum residues from atmospheric distillation or vacuum distillation was investigated in the study, and various entrainers were studied for their qualitative and quantitative effects. A special apparatus for high-pressure phase equilibrium measurement was designed and constructed for this purpose. The apparatus works at temperatures between 20°C and 300°C and pressures up to 300 bar. The apparatus was tested in the systems n-heptane/nitrogen and hexadecane/nitrogen.

25237 Evaluation of flue gas desulfurization systems for thermally enhanced oil recovery operations in California. Osterhout, D.R.; Patkar, A.N.; Tuttle, J.D. *Enhanced Oil & Gas Proc.;* **3**: E.1.1-E.1.20(1979). (CONF-790805—P3).

From DOE symposium on enhanced oil and gas recovery and improved drilling technology; Tulsa, OK, USA (22 Aug 1979).

Pedco Environmental, Inc., is conducting a review of currently available flue gas desulfurization (FGD) technology as it applies to thermally enhanced oil recovery (TEOR) operations in California. The US Department of Energy contracted this review because TEOR steam production frequently utilizes fuel containing sulfur levels that produce significant sulfur dioxide (SO_2) emissions. The review performs 2 functions: (1) it will assist the oil companies

as they make decisions concerning FGD implementation; and (2) it will aid in planning future research and development needs.

0209 Environmental Aspects

REFER ALSO TO CITATION(S) 25812

25238 **(DOE/EA—0252) Environmental assessment: Strategic Petroleum Reserve Seaway Complex distribution enhancements, Brazoria, Galveston, and Harris Counties, Texas.** (USDOE Assistant Secretary for Fossil Energy, Washington, DC. Office of the Deputy Assistant Secretary for Strategic Petroleum Reserve). Dec 1984. 64p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85010664.

The Strategic Petroleum Reserve (SPR) of the US Department of Energy proposes to construct and operate a 42-inch buried crude oil pipeline, between 48 and 53 miles long, to transport crude oil from existing facilities of the SPR Seaway Complex located near Freeport, Texas, to an existing commercial crude oil terminal near Texas City, Texas. Three subalternative pipeline segments are under consideration for the origin of the route at the SPR Bryan Mound storage site located near Freeport, Texas. Crude oil throughput for all cases is 1,315,000 bpd. The environmental impacts of the proposed action are related to pipeline construction and operation. Potential impacts from pipeline construction are primarily concerned with prime farmland and wetlands. The use of "double ditching" techniques to restore original soil profile will minimize impacts to prime farmlands, and impacts on wetlands. Compliance with US Army Corps of Engineers permit conditions (which specify restoration of land to original contours, disposal of spoil in upland areas, and revegetation of riparian areas) will mitigate impacts on wetlands. Water use during pipeline testing in accordance with permit conditions is not expected to be significant. Potential impacts from pipeline operation are primarily concerned with accidental releases of crude oil to the environment. As a worst-case, 0.01 spill events would occur during one six-month drawdown, and the volume of oil spilled would be about 18,000 bbl for the pipeline. Because the pipeline will be buried, the occurrence of a major pipeline break releasing large quantities of crude oil is unlikely. Testing and inspection of buried pipeline, and the development of an oil spill contingency plan will reduce the seriousness of an oil spill. Impacts on floodplains are also expected to be minor. 20 refs., 4 figs., 2 tabs.

25239 **(USGS-OFR—83-567) Oilspill risk analysis for the North Atlantic (February 1984) lease offering.** Amstutz, D.E.; Samuels, W.B. (Minerals Management Service, Reston, VA (USA)). May 1983. 179p. US Geological Survey, Box 25425, Denver, CO 80225. File Number TI85901353.

This analysis characterizes the oilspill risks involved in the leasing of proposed areas off the Northeastern coast. Assuming the high volume scenario, in which 0.301 billion barrels of oil are estimated to be present and produced, the probability that one or more oilspills of 1000 barrels or larger will occur and contact land within 30 days travel time is 5% (95% chance that this will not happen). The probability that one or more oilspills of 1000 barrels or greater will occur and contact land within 30 days from production and transportation from existing leases and imports is 89%. Thus, spills from the proposed action are dwarfed by those associated with oil imports. Examination of the probabilities for spills (≧ 1000 bbls and ≧ 10,000 bbls) occurring and contacting land and the 29 targets within 30 days travel time reveals no statistically significant difference among the proposal and the four deletion alternatives. Similiarily, there is no statistically significant difference between the mean and high volume cases. From the proposed lease area, the highest conditional probabilities to contact land within 30 days occur for Nova Scotia (approximately 30%). The highest conditional probabilities to contact the United States coastline within 30 days are to Nantucket Island (8%). The risks from spills, however small, would be mitigated to the extent that weathering and decay of oil occurs at sea, and by the success of any spill countermeasures which could be attempted. These effects were not directly included in this oilspill model, but should be considered in translating the spill contacts predicted by this study into spill impacts for environmental analysis. 14 refs., 7 figs., 41 tabs.

25240 **Environmental impact statement for DOE's enhanced oil recovery RD & D program.** Bowman, B.; Cole, J.; Friedman, P.; Greene, R. *Enhanced Oil & Gas Proc.;* 3: E.3.1-E.3.13(1979). (CONF-790805—P3).

From DOE symposium on enhanced oil and gas recovery and improved drilling technology; Tulsa, OK, USA (22 Aug 1979).

The enhanced recovery processes which are assessed are steam injection, in situ combustion, CO_2 injection, micellar-polymer flooding, and improved waterflooding. Potential environmental impacts characteristic of each process are discussed, as well as the cumulative impacts attributable to the DOE program.

0220 Transport, Pipelines, And Handling

REFER ALSO TO CITATION(S) 25238

0230 Properties

REFER ALSO TO CITATION(S) 25139

0240 Storage

25241 **(PB—85-163798/XAB) Microbial aspects on oil storage in rock caverns.** Roffey, R.; Norqvist, A.; Edlund, A. (Foersvarets Forskningsanstalt, Umeaa (Sweden)). Sep 1984. 40p. (In Swedish). (FOA-C—40203-B4). NTIS, PC E04/MF E01.

Following the increased use of petroleum products during this century it has been found that the quality of stored petroleum products can be affected especially during long-term storage. Research work has shown that some of these problems can be caused by microorganisms within the hydrocarbon bulk or at the interphase between hydrocarbon and water. In Sweden a large number of rock caverns for long-term storage of different petroleum products have been constructed. These caverns are situated underground below the ground water table so that the water pressure keeps the oil in place. During the last years a few microbial problems have been observed in caverns where jet fuel and heating oil have been stored. It is environmental situation, type of stored petroleum product and microbial activity that governs if problems will or will not appear. In this report the mechanisms by which microorganisms can cause various problems during storage in rock caverns are presented. Microbial investigations in caverns with problems are discussed. The effect of different methods to inhibit the microbial activity in laboratory systems and their applicability in rock caverns are also discussed.

25242 **(SAND—84-1544C) Thermal model for fluids stored in the US Strategic Petroleum Reserve caverns.** Tomasko, D. (Sandia National Labs., Albuquerque, NM (USA)). 1 Nov 1984. Contract AC04-76DP00789. 28p. (CONF-850614—2). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85002626.

From ASME-ASCE fluids engineering conference and joint mechanics conference; Albuquerque, NM, USA (24 Jun 1985).

Fluid temperatures within the Strategic Petroleum Reserve (SPR) caverns are calculated using a modified one-dimensional, time-dependent Rahm-Walin equation coupled to a two-dimensional, time-dependent heat conduction equation in the salt massif. Comparisons of model results with experimental data from West Hackberry cavern 11 (WH-11) and Bryan Mound cavern 4 (BM-4) are very good for up to eight years of cavern life. 12 refs., 10 figs., 3 tabs.

25243 **(SAND—84-2137C) Physical and numerical simulations of fluid-filled cavities in a creeping material.** Preece, D.S.; Sutherland, H.J. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 8p. (CONF-850671—15). NTIS, PC A02/MF A01; GPO Dep. File Number DE85009439.

From 26. U.S. symposium on rock mechanics; Rapid City, SD, USA (26 Jun 1985).

The finite element method has been used for several years to calculate the creep closure of Strategic Petroleum Reserve (SPR) storage cavities in rock salt. The two-dimensional axisymmetric finite element calculations performed thus far have required many simplifying assumptions to reduce the three-dimensional cavern geometries to two dimensions (Preece and Foley, 1984). Centrifuge testing has been employed to qualify the finite element program on a well-controlled laboratory experiment which bears resemblance to an oil-filled cavern in rock salt. Centrifuge testing produces an acceleration induced geostatic stress field around the cavity similar to that around an actual cavity in rock salt. The three centrifuge experiments reported here were single cavity tests which were performed at three different accelerations and employed the creeping material plasticine. Plasticine was used because it gives measurable cavity closure in a reasonable centrifuge test time. These preliminary experiments had two purposes: (1) explore the feasibility of creep testing on the centrifuge, and (2) provide an experiment with well-controlled boundary conditions and material properties for qualifying a two-dimensional axisymmetric finite element computer program with creep capability. The single cavity centrifuge experiments and the attending two-dimensional finite element analyses are presented in this paper. 9 refs., 6 figs.

0250 Combustion

25244 (CONF-8410156—6) Physical and chemical characteristics of cenospheres from the combustion of heavy fuel oil. Clayton, R.M. (Jet Propulsion Lab., Pasadena, CA (USA)). 1984. Contract AI01-81CS66001. 22p. (WSS/CI—84-76). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010118.

From Fall meeting of the Western States Section of the Combustion Institute; Stanford, CA, USA (22 Oct 1984).

The microscopic (optical and SEM) studies showed that typical large (100 to 200 μm) and small (20 to 40 μm) cenospheres are spheroidal and hollow, and have at least one blowhole that extends from the hollow core through the shell of the cenosphere. The size of the blowholes cover the range of 10 to 50% of the cenosphere diameter. The ratio of outer to inner diameter of the shell appears to be of the order of 1.3 to 1.4. The shells of large particles tend to be sponge-like in appearance with an interconnected porous structure. The shells of the smaller particles are smoother but contain many pores of the order of a few μm diameter. The solid portions of the shell in either case appear flakey or layered and the interstitial space between flakes or layers may contribute to microporosity. Standard methods of surface area and porosity distribution analyses established, as expected, that the large pores contributed most to total pore volume whereas the small pores contribute most to total surface area. Density determinations based on mercury intrusion and helium displacement techniques indicate that a typical individual cenosphere contains only about 18% solid material on a volumetric basis. These observations are consistent with the hollow, porous structure established microscopically. It is anticipated that ongoing work will use the results reported here in developing an analytical model of cenosphere which will take into account the geometrical structure of the typical cenosphere (albeit in a simplified way) and the diffusion processes necessary to transport oxygen throughout the structure to the carbonaceous surfaces. Insights gained from such a model hold promise of guiding future efforts to enhance the burnout of cenospheres within a furnace or boiler and thus reduce their deleterious effects on corrosion, emissions, and combustion efficiency. 3 refs., 8 figs., 4 tabs.

03 NATURAL GAS

0301 Reserves

25245 (PB—85-171114/XAB) Studies related to the deep earth gas: 1983 annual report. Gold, T. (Cornell Univ., Ithaca, NY (USA)). 20 Mar 1984. 50p. NTIS, PC A03/MF A01.

See also PB83-244004.

The report investigates the role of abiogenic methane in the outgassing of the Earth, specifically to determine whether there is a large enough supply of deep abiogenic methane to contribute significantly to our energy needs and, if so, whether it is possible to tap the supply. Three experimental and two theoretical lines of research were pursued. The question of whether abiogenic methane could contribute to petroleum deposits was investigated by two experiments: inverse cracking and methane pyrolysis. The objective of the inverse cracking experiment is to determine whether methane can react with hydrocarbons at temperatures and pressure conditions common to petroleum reservoirs in the presence of natural catalysts to form higher hydrocarbons. An experiment using C-14 tagged methane in contact with various hydrocarbons has been conducted with initially positive results.

0302 Geology And Exploration

25246 (DOE/METC/SP—215) Deep source gas. (USDOE Morgantown Energy Technology Center, WV). Feb 1985. 26p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85001984.

Three separate emplacement concepts could explain the occurrence of gas at extreme depths: abiogenesis (a primordial, nonbiologic origin source); subducted, organic-origin gas (involving the deep, tectonic subduction emplacement of hydrocarbon-generating ocean sediments); and deep sedimentary basin gas (the more conventional emplacement of sedimentary rocks by deep downwarping of the Earth's crust). Of these concepts, Deep Source Gas research focuses on the subducted, organic-origin concept. The purpose of Deep Source Gas research is to verify natural gas arising from depths in excess of 30,000 feet, to relate these occurrences to conceptual models, to define the limits of target areas, to quantify the resource, and to determine the significance of the gas to the nation's reserves. The research emphasizes an Earth science study (geology, geochemistry, and geophysics) of the Cordilleran Geologic Province of western North America. This area is considered a prospective source largely because of known and suspected plate tectonic structures and their youthful emplacement, which increase the likelihood of a timely entrapment of deep-source generated hydrocarbons. Detailed geochemical studies indicate that the deep-source-gas generating capacity of the Aleutian Trench area of southern Alaska is high. Furthermore, geophysical studies show that an apparent fossil subduction zone exists in western Washington. This zone appears to have very thick sedimentary rock units, the existence of which will be evaluated through a more detailed seismic study and possibly through drilling activities. Structural observations made in the northern Brooks Range and central Alaskan Range indicate that overthrusting and compressional features may serve as large-scale target areas for deep source gas generation and occurrence. 12 figures, 2 tables.

25247 (DOE/METC/SP—218) Gas hydrates. (USDOE Morgantown Energy Technology Center, WV). Apr 1985. 36p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85001986.

There is a definite need for the US government to provide leadership for research in gas hydrates and to coordinate its activities with academia, industry, private groups, federal agencies, and their foreign counterparts. In response to this need, the DOE Morgantown Energy Technology Center implemented a gas hydrates R & D program. Understanding the resource will be achieved through: assessment of current technology; characterization of gas hydrate geology and reservoir engineering; and development of diagnostic tools and methods. Research to date has focused on geology. As work progressed, areas where gas hydrates are likely to occur were identified, and specific high potential areas were targeted for future detailed investigation. Initial research activities involved the development of the Geologic Analysis System (GAS); which will provide, through approximately 30 software packages, the capability to manipulate and correlate several types of geologic and petroleum data into maps, graphics, and reports. Preliminary mapping of hydrate prospects for the Alaskan North Slope is underway. Geological research includes physical system characterization which focuses on creating synthetic methane hydrates and developing synthetic hydrate cores using tetrahydrofuran, consolidated rock cores, frost base mixtures, water/ice base mixtures, and water base mixtures. Laboratory work produced measurements of the sonic velocity and electrical resistivity of these synthetic hy-

drates. During 1983, a sample from a natural hydrate core recovered from the Pacific coast of Guatemala was tested for these properties by METC. More recently, a natural hydrate sample from the Gulf of Mexico was also acquired and testing of this sample is currently underway. In addition to the development of GAS, modeling and systems analysis work focused on the development of conceptual gas hydrate production models. 16 figs., 6 tabs.

25248 **(LA-UR—84-1140) Crosswell acoustic surveying in gas sands: travel-time pattern recognition, seismic Q and channel waves.** Albright, J.N.; Johnson, P.A. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 20p. (CONF-8506104—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010777.

From 26. Society of Professional Well Log Analysts annual logging symposium; Dallas, TX, USA (17 Jun 1985).

The application of crosswell acoustic measurements to gas sands research has been explored through surveys conducted in the Mesa Verde formation at the Department of Energy Multi-Well Experiment (MWX) site near Rifle, Colorado. The borehole tools used in the survey are similar in concept to those used in commercial service for sonic logging, but they are especially adapted for the stringent requirements of crosswell shooting in hot gas wells. Important information about the geologic structure between wells can be extracted from crosswell scans without resorting to elaborate processing. A useful representation is a display of the travel time of P-waves in terms of the cylindrical coordinates of the transmitter referenced to the receiver. This is known as a gamma-depth (γ-Z) plot. Such a representation may yield distinctive patterns, which can be interpreted based on the successful replication of the pattern through computer simulations. The apparent seismic Q of P-waves transmitted through the sands at the MWX site is derived using two methods. The first applies to crosswell surveys in which signals can be acquired over a significant range of source-receiver distances. A Q of 15 between well pair MWX 1/2 is derived in this manner. The second method makes use of signals transmitted between wells in a three-well complex and provides an estimate of seismic Q for the rocks bounded by each well pair. Q estimates derived from this technique are 18, 30, and 28 for well bores MWX-1/2, MWX-2/3 and MWX-3/1, respectively. Channel waves propagate through the MWX coals. Evidence suggests that tube waves launched in the transmitter well give rise, under appropriate conditions, to channel waves, which in turn excite tube waves in nearby wells that penetrate the same channel. Although the sequence of conversions is weak, the resulting waveforms are coherent enough to resolve the channel waves through stacking. 8 refs., 10 figs.

25249 **(LA-UR—85-1139) In-situ physical properties measurements using crosswell acoustic data.** Johnson, P.A.; Albright, J.N. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 10p. (CONF-8505115—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010778.

From SPE/DOE symposium on low permeability reservoirs; Denver, CO, USA (19 May 1985).

SPE Paper 13881.

Crosswell acoustic surveys enable the in-situ measurements of elastic moduli, Poisson's ratio, porosity, and apparent seismic Q of gas-bearing low-permeability formations represented at the Department of Energy Multi-Well Experiment (MWX) site near Rifle, Colorado. These measurements, except for Q, are compared with laboratory measurements on core taken from the same depths at which the crosswell measurements are made. Seismic Q determined in situ is compared to average values for sandstone. Porosity was determined from crosswell data using the empirical relationship between acoustic velocity, porosity, and effective pressure developed by Domenico. Domenico, S.N., "Rock Lithology and Porosity Determination from Shear and compressional Wave Velocity," Geophysics, Vol. 49, No. 9, Aug. 1984, pp. 1188-1195. In-situ porosities are significantly greater than the core-derived values. Sources of the discrepancy may arise from (i) the underestimation of porosity that can result when Boyle's Law measurements are made on low-permeability core and (ii) the application of Dominico's relationship, which is developed for clean sands, to the mixed sandstone and shale lithologies represented at the MWX site. Values for Young's modulus and Poisson's ratio derived from crosswell measurements are comparable to values obtained from core. Apparent seismic Q measured in situ between wells is lower than Q measured on core and clearly shows the heterogeneity of sandstone deposited in a fluvial environment. 16 refs., 4 figs., 2 tabs.

0303 Drilling, Production, And Processing

REFER ALSO TO CITATION(S) 25225, 25967

0305 Health And Safety

REFER ALSO TO CITATION(S) 25251, 25252, 25257

25250 **(PB—85-174530/XAB) Safety research plan for gas-supply technologies. Final report, March 1982-February 1983.** Tipton, L.M.; Junkin, P.D. (TRW, Inc., McLean, VA (USA)). Jun 1983. 194p. (REPT—98600-20). NTIS, PC A09/MF A01.

See also PB83-228387.

The objective of this study was to develop a multiyear research plan addressing the safety issues of the following gas supply technologies: conventional natural gas, including deep and sour gas wells; unconventional natural gas (Devonian shale, tight gas sands, coalbed methane, and geopressured methane); SNG from coal (surface and in situ), and SNG from biomass. A total of 51 safety issues were identified in the initial review. These safety issues were screened to eliminate those hazards which appeared to be relatively insignificant in terms of accident severity or frequency, or because the potential for resolving the problem through research was considered very low. Twenty-six remaining safety issues were prioritized, and of these, 9 were selected as priority research projects: two under conventional gas; one under unconventional natural gas; and six under SNG from coal. No safety research issues in the biomass area appear to warrant priority consideration.

0306 Marketing And Economics

REFER ALSO TO CITATION(S) 25233, 25235, 25699, 25700, 25712

0308 Environmental Effects

REFER ALSO TO CITATION(S) 25174, 25258

25251 **Numerical simulation of liquefied fuel spills. Part 1. Instantaneous release into a confined area.** Brandeis, J.; Kansa, E.J. (Lawrence Livermore National Lab., CA). *International Journal for Numerical Methods in Fluids;* 3: 333-345(Jul-Aug 1983).

Numerical solutions to shallow-water equations in radial symmetry simulate several possible situations resulting from a hypothetical collapse of a storage tank surrounded by an impounding dike. Analysts compare three categories of spills into a diked area: liquid on a layer of the same liquid, liquid on a solid surface, and LNG on water. LNG spills on water show the slowest spreading rate. Test results demonstrate that the present height requirements for the impounding dike are insufficient to totally contain a worst-case dynamic spill, especially on a solid surface.

25252 **Numerical simulation of liquefied fuel spills. Part 2. Instantaneous and continuous LNG spills on an unconfined water surface.** Brandeis, J.; Ermak, D.L. (Lawrence Livermore National Lab., CA). *International Journal for Numerical Methods in Fluids;* 3: 347-361(Jul-Aug 1982).

LLNL's simple numerical model, based on shallow-water equations, examined the similarities and differences in the pool structure for continuous and instantaneous spills of LNG on a water surface. The results confirm that a continuous spill over a short duration gives rise to a pool structure characteristic of an instantaneous spill. For instantaneous spills, the maximum pool radius and the time required to reach it vary linearly with the spill volume on a logarithmic plot. With continuous spills, increasing the radius of the source decreases the rate of pool spreading. Researchers also

studied models for shear stress and evaporation to account for pool breakup.

0309 Artificial Stimulation

REFER ALSO TO CITATION(S) 26242

25253 **(PB—85-174902/XAB) Hydrologic characterization of coal seams for methane recovery--Activity 1 topical report: hydrologic data base for Piceance, San Juan, and Warrior Basins. Final report, January-March 1983.** Way, S.C.; Bumb, A.C.; Koenig, R.A.; McKee, C.R.; Reverand, J.M. (In-Situ, Inc., Laramie, WY (USA)). Feb 1984. 68p. NTIS, PC A04/MF A01.

Attempts to produce methane from coal seams have frequently encountered large volumes of water which must be removed to reduce reservoir pressure and improve permeability to gas, and hence allow methane drainage. Knowledge of the hydrologic properties of a target coal seam will enable selection of favorable sites for field testing and final methane recovery, and will provide information needed to design an effective dewatering program. The objective of the study is to characterize the hydrologic properties of coal seams in selected basins by collecting and analyzing data from available sources. A lack of hydrologic information for all the basins studied was encountered. The information available showed a general correlation between depth of burial and permeability in which the formation tightens with increasing depth. Permeability contour maps were constructed based on the individual correlations for each basin. Caution is recommended when using these correlations, since geologic structure (e.g., folding) may cause localized variations in permeability. No trends were noted for the occurrence of water in coal seams or for variations in reservoir pressure.

25254 **(PB—85-175180/XAB) Development of a geopressured energy management information and analysis system in support of research planning. Final report, October 1983-September 1984.** Wrighton, F.M.; Veal, L.K. (Louisiana State Univ., Baton Rouge (USA). Center for Energy Studies). Jan 1985. 45p. NTIS, PC A03/MF A01.

See also PB83-232769.

Geopressured and hydropressured (normally pressured) aquifers containing mobile gas in thin stringers, immobile gas, and gas in solution are known to occur in the Gulf Coast areas of Louisiana and Texas. If it should prove technically and economically feasible to produce this gas, this unconventional resource could make a substsntial contribution to the nation's gas supply. LSU's role in the development of this resource was to design and implement an energy management information and analysis system to support research planning for the co-production of gas and water concept. This basic research supports GRI's goal of stimulating the commercialization of gas recovery in the near-term. This study has also developed a database and information system on the problems and potential of unconventional gas resource options in the Gulf Coast and the assessment of each option's potential and remaining problems. This research resulted in the development of a research program designed to prove economic and technical feasibility of the co-production technique. Industry contacts were established and operator interest provided data on possible sites for a potential co-production field study. An information system was established to house all relevant data and documents generated during this research project.

25255 **(PB—85-180214/XAB) Development of coal gas production simulators and mathematical models for well test strategies (computer model for an array of vertical wells and overview of contract results). Final report, May 1981-December 1983.** Pavone, A.M.; Schwerer, F.C. (United States Steel Corp., Monroeville, PA. Technical Center). Apr 1984. 609p. (REPT—76-H-076(007-1)). NTIS, PC A99/MF A01.

See also PB84-104918.

A computer program, designated ARRAY and written in a structured dialect of FORTRAN, has been developed to simulate the transient, two-dimensional (areal) two-phase flow of methane gas and water through a coal seam to an array of vertical wells. The coal seam is modelled as a dual porosity medium which incorporates time-dependent, nonlinear sorption of methane on internal surfaces of the coal matrix. A number of flow phenomena can optionally be included in the model such as non-laminar flow, gas slippage, coal seam compressibility, stress-sensitive permeability, and stratified flow. This is the third in a series of computer models for production of methane from coal seams. Models WELL1D - for production by an isolated, unstimulated vertical well or by an isolated vertical well connected to an induced, high-conductivity (constant pressure) vertical fracture - and WELL2D - for production by an isolated vertical well connected with an induced, finite-conductivity vertical fracture - were presented previously in an Annual and a Topical Report for this contract. An extensive bibliography derived from a computer-assisted search of the technical literature also was presented in the Annual Report.

0320 Transport, Pipelines, And Handling

25256 **(PB—85-161784/XAB) Nippon Kokan Technical Report No. 104, 1984.** (Nippon Kokan K.K., Tokyo). [1985]. 210p. (In Japanese). NTIS, PC E10/MF E01.

See also PB85-105070, and PB85-161792.

Contents include: Fracture toughness of 9% Ni steel and safety of LNG storage tank against brittle fracture; Fatigue strength and safety assessment of membrane components; Comparison between membrane and spherical independent system LNG carriers; Diesel-driven LNG carrier with reliquefaction plant; Construction of TGZ MK I system LNG carrier model tank and its cryogenic tests; TGZ Mark III containment system and its fatigue strength; Quality assurance system of membrane tank of LNG carrier; Vacuum insulation test using LNG model tank; Estimation of impact pressure and hydrodynamic force due to sloshing in LNG carrier; Higashi-Ohgishima LNG receiving facility for the Tokyo Electric Power Co., Inc.; Design of LNG receiving facility; Safety system in LNG receiving facility; Start-up of LNG receiving facility; Receiving and circulation control system of Higashi-Ohgishima LNG terminal; LNG sampling facility; Welding procedure for LNG pipelines; Brief records of low temperature storage tank construction; The design method of inground LNG storage tank; The design method of aboveground LNG storage tank; Annular shape structure in cylindrical flat bottom tank; Various applications of LNG tank roll-over simulation program ROSP; LNG satellite facility; Submarine cryogenic pipeline for loading and unloading of LNG.

0330 Properties

REFER ALSO TO CITATION(S) 25247

0340 Combustion

REFER ALSO TO CITATION(S) 25512

25257 **Transient growth of an unconfined pool fire.** Cline, D.D.; Koenig, L.N. (Sandia National Labs., Albuquerque, NM). *Fire Technology;* **19**: 149-162(Aug 1983).

Developed from simple mass balance considerations, Sandia's analytical model describes the time-dependent growth of an unconfined pool fire. Analytical studies and recent experiments reveal that (1) large pool fires may evolve in seconds, resulting in fires that are extremely hazardous and difficult to control, (2) the size of free-spreading pool fires is limited by the balance between the fuel supplied to the pool and the mass loss from the pool's surface due to burning, (3) when ignition of the fuel pool is delayed, the initial spill conditions are important in characterizing the pool fire development during post-ignition time, (4) a set of simlarity parameters may be defined that uniquely characterize the transient pool growth in dimensionless variables, and (5) future spill-fire simulations could be conducted on a small scale using evaporative fluids that are safe and nonflammable.

0350 Storage

REFER ALSO TO CITATION(S) 25256

25258 Analysis of liquefied natural gas (LNG) release prevention systems. Pelto, P.J.; Baker, E.G. (Pacific Northwest Laboratory, Richland, Washington). *AIChE National Meeting;* No. 2D, 21(Aug 1984). (CONF-840828—).

From International synfuels policies and technologies symposium; Philadelphia, PA, USA (19 Aug 1984).

Liquefied Natural Gas (LNG) is playing an important role in meeting the energy needs of the U.S. and other countries. Since one unit volume of LNG is equivalent to 600 unit volumes of natural gas, liquefaction permits large volumes of gas to be economically stored and transported. In the United States, LNG has a twenty-year record of safe handling and use. However, as is true for all large-scale energy related industries, LNG operations have some potential for accidents that present risks to property and life. Expected changes in industry size and characteristics and the desire to increase knowledge about safety related issues have generated the need for safety and environmental control assessments of the LNG industry.

04 OIL SHALES AND TAR SANDS

0401 Reserves And Exploration

REFER ALSO TO CITATION(S) 25180

0402 Site Geology And Hydrology

25259 (NP—5901364) Subsurface petroleum geology of Santa Rosa Sandstone (Triassic), northeast New Mexico. Broadhead, R.F. (New Mexico Bureau of Mines and Mineral Resources, Socorro (USA)). 1984. 78p. New Mexico Bureau of Mines and Mineral Resources, Socorro, NM 87801. File Number TI85901364.

Circular 193.

The Santa Rose Sandstone (Triassic) occurs at depths of less than 2000 ft over most of northeast New Mexico. Although the Santa Rosa Sandstone is currently not producing, two major petroleum accumulations are known to exist in it. One accumulation is located approximately 6 miles north of Santa Rosa, where oil-impregnated Santa Rosa Sandstone crops out; these outcrops of oil-impregnated sandstone are known as the Santa Rosa tar sands. The oil in the tar sands is viscous and heavy. The Santa Rosa tar sands were mined in the 1930's for road-surfacing material, but presently are not being worked. The other known petroleum accumulation in the Santa Rosa Sandstone is a pool of heavy oil that occurs at depths of 400 to 800 ft in northeast Guadalupe County. Attempts are being made to recover the heavy oil with steamflooding in two small pilot fields, the O'Connell Ranch field and the T-4 Ranch field. Stratigraphic and petrographic studies indicate that good reservoirs are widespread in the lower and upper sandstone units in northeast New Mexico. The blanket geometry of the lower and upper sandstone units indicates that structure probably plays an important or even dominant role in the trapping of any undiscovered hydrocarbons in the Santa Rosa. Oil proximal to the outcrop belt of the Santa Rosa Sandstone has probably been flushed by recently recharged, fresh ground water. Although the source of the oil in Santa Rosa Sandstone is not definitely known, geochemical studies point to the San Andres Formation (Permian) or possibly Pennsylvanian rocks. 38 refs., 14 figs., 3 tabs.

0403 Drilling, Fracturing, And Mining

25260 (SAND—84-2135C) Rock motion modeling of oil shale cratering experiments. Gorham-Bergeron, E. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 9p. (CONF-850671—11). NTIS, PC A02/MF A01; GPO Dep. File Number DE85008402.

From 26. U.S. symposium on rock mechanics; Rapid City, SD, USA (26 Jun 1985).

This paper describes the structure and functioning of the rock motion code CAROM. CAROM (CAlculated ROck Motion) is a stabilized and improved version of the rudimentary motion code BUMP (Schamaun, 1984), developed at Sandia National Laboratories for the in situ oil shale recovery program. The paper also provides results of CAROM calculations of material motion during blasting of a single borehole in rock and comparison with motion measurements made for cratering tests conducted in oil shale by Sandia (Parrish, 1984) in 1983. 9 refs., 5 figs., 1 tab.

25261 (SAND—85-0177) Experiment plan Sandia oil shale Rock Fragmentation Research Program. Parrish, R.L. (Sandia National Labs., Albuquerque, NM (USA)). Apr 1985. Contract AC04-76DP00789. 45p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85010623.

Sandia National Laboratories is engaged in a program to develop a prescriptive design capability for the in situ recovery of oil from shale. This will provide industry a firm basis for evaluating the technical and economic potential of a given process. Emphasis is being placed on the development of numerical models that, for given site characteristics (material properties, geological structure, etc.), would provide predictions of oil yield for a particular resource. The models include rock fragmentation models that would provide predictions of rubble bed characteristics; these rubble beds would then be evaluated with retort process models for predictions of oil yield. The Rock Fragmentation Research Program being conducted to develop the rock fragmentation models includes field experiments specifically designed to acquire quantitative diagnostic and response measurements for use in the model development. Two well-instrumented single blastwell cratering experiments were conducted in this program during 1983 at the DOE Anvil Points Mine. The Anvil Points Mine was closed in 1984; continuation of the experimental program will be at the Exxon Co., USA Colony Mine. This report describes the test plan for the continuation of the rock fragmentation experiments. A discussion of program objectives and testing philosophy is provided, followed by a description of the experiments thought necessary to accomplish the program objectives. A detailed design and instrumentation plan is provided for the first series of tests to be conducted. 38 refs., 13 figs., 6 tabs.

0404 Oil Production, Recovery, And Refining

REFER ALSO TO CITATION(S) 25260, 25261

25262 (DOE/FE/60177—1791) Comparison of isothermal kerogen decomposition results using reactors with different heat-up rates. Conn, P.J.; Rollison, H.J.; Miknis, F.P. (Western Research Inst., Laramie, WY (USA)). Oct 1984. Contract FC21-83FE60177. 32p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85008563.

Three types of isothermal reactors have been tested for possible use in shale retorting studies. In each reactor the pyrolysis reaction has been quenched after variable time periods in order to analyze the reaction intermediates and products. Although the reactors have had widely different features and capabilities, all three have been given the same pyrolysis rates when the effect of heat-up rate on reaction time was considered. A sand bath-heated reactor was developed in this work which is capable of heating 20-gram shale samples to reaction temperature in about three minutes. Quantitative recovery of liquid, gaseous and solid products (100.0 +- 0.1%w basis shale) has been achieved. This system will be used in future isothermal kinetic studies. 14 refs., 11 figs., 5 tabs.

25263 (PB—85-153856/XAB) Fluidized-bed retorting and gasification of Devonian shale. Final report, 1983-1984. Hatcher, W.J. (Alabama Univ., University (USA). School of Mines and Energy Development). Oct 1984. 29p. NTIS, PC A03/MF A01.

There are vast quantities of Devonian shale in the Eastern United States, including the state of Alabama. The energy potential amounts to several hundred years of total equivalent crude oil demand in the United States. Most of the prior research on Devonian shale by conventional retorting methods resulted in oil yields of only about half that of oil shales from the Western United States even though the total organic carbon content of the Eastern and

Western shales are comparable. Experiments involving the retorting of granular shale under hydrogen atmospheres resulted in recoveries of organic carbon from Devonian shale exceeding eighty percent. This compares favorably with recoveries from Western shale. Other studies involved the gasification of shale char and the development of fluidized-bed-reactor design models for evaluation of various process alternates.

25264 **(SAND—85-0197) Oil shale pilot retorting experiment summary: block permeability contrast Run 41.** Tyner, C.E.; Cook, D.W.; Engler, B.P. (Sandia National Labs., Albuquerque, NM (USA)). Mar 1985. Contract AC04-76DP00789. 94p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85010774.

Three previous 100-kg oil shale pilot retorting experiments have been conducted to determine the importance of permeability contrast effects on oil yield loss mechanisms. These experiments showed that flow non-uniformities within a retort could cause yield losses of the same magnitude (or greater) than those caused by particle size, grade, or operating conditions. In Run 41, an extreme permeability contrast case was created by using a 19.4 cm diameter by 94 cm high solid shale core as the center zone of the retort. Temperature contours during retorting were similar to those observed in other permeability contrast experiments. However, the amounts of remaining char and unreacted carbonate materials were higher than for previous experiments. Oil yield was 80% of Fischer Assay, compared to 86 to 89% for other permeability contrast runs (with 3:1 contrasts) and 95% for a uniform base case. The additional yield loss was apparently caused by a combination of enhanced non-uniformity and increased particle size. Modeling of the process (using a previously-developed block retorting model) showed excellent agreement between the predicted temperature and char profiles and those observed in the test. These comparisons help to validate the physical and chemical descriptions of the process used in the model. 14 refs., 24 figs., 9 tabs.

0405 Properties And Composition

25265 **(DOE/FE/60177—1792) Data base of all known, published data on trace elements in oil shale and its products.** George, M.; Jackson, L. (Western Research Inst., Laramie, WY (USA)). Dec 1984. Contract FC21-83FE60177. 27p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85003399.

A computerized bibliographic data base has been developed by Western Research Institute (WRI) for storage and retrieval of literature references pertinent to trace elements in oil shale and its products. This data base is a Compendium of Oil Shale Trace Metals literature (COSTM). It provides assistance for researchers in obtaining oil shale trace element literature references in their specific area of interest. Over 500 references were obtained and evaluated. Three hundred and seventy-five of these references were suitable for entry in the data base. Retrieval can be made by several specific data parameters. 4 figs.

0410 Enviromental Aspects

REFER ALSO TO CITATION(S) 25173, 25174

25206 **(PB—85-156248/XAB) Auto-oxidation potential of raw and retorted oil shale. Summary report.** Green, D.A. (Research Triangle Inst., Research Triangle Park, NC (USA)). Sep 1984. 163p. NTIS, PC A08/MF A01.

This paper discusses an EPA-sponsored study to assess the potential environmental impacts of leachates from raw mined western oil shales. The study was undertaken as a cooperative effort of the Environmental Protection Agency, Colorado State University, Rio Blanco Oil Shale Company, Cathedral Bluffs Shale Oil Company, and the Oil Shale Project Office of the Bureau of Land Management. This paper presents the results of three years evaluation of the quantity and chemical characterization of leachates generated from onsite field collectors along with laboratory shale tests on raw mined oil shales from the C-a and C-b Federal lease tracts in western Colorado. The findings are indicators of the levels of common and trace species that can be expected to occur in field generated raw shale leachates.

05 NUCLEAR FUELS

0501 Reserves

25267 (IAEA-TECDOC—315, pp 7-34) **Proterozoic strata-bound uranium deposits of Zambia and Zaire.** Meneghel, L. (AGIP Nucleare, Milan (Italy)). Oct 1984. NTIS (US Sales Only), PC A15/MF A01. File Number DE85780873.

In Proterozoic unconformity and stratabound uranium deposits. Report of the working group on uranium geology organized by the IAEA.

The Katanga System, host to uranium and copper mineralisation, is several thousands of metres thick and rests unconformably on an older complex of crystalline rocks and metasediments and is locally covered by Karoo sandstones or Kalahari sands. The deposition of the Katanga System took place during the Late Proterozoic in a wide complex basin extending from Shaba province in Zaire through a large part of Zambia and into eastern Angola. The sediments were affected by different grades of metamorphism, tectonic events, and by thermal events associated with post-tectonic metamorphism. At the base of Katanga system there are 84 known copper deposits and 42 uranium occurrences. It is suggested that all the known uranium and copper occurrences are of an essentially syngenetic sedimentary origin. The mineralisation is found in the Lower Roan Formation near the base of the Katanga System occurring in rocks produced in similar environmental conditions and thus being stratigraphic controlled, however, their areal distribution is localised producing a regional metal zonation. Many of the uranium occurrences have a typical vein aspect. These transgressive relationships are not inconsistent with a syngenetic origin as evidenced by the vein morphology.

25268 (IAEA-TECDOC—315, pp 35-67) **Uranium in early proterozoic Aillik Group, Labrador.** Ferguson, J. (ed.). Oct 1984. NTIS (US Sales Only), PC A15/MF A01. File Number DE85780873.

In Proterozoic unconformity and stratabound uranium deposits. Report of the working group on uranium geology organized by the IAEA.

Uranium occurrences are widely distributed in tuffaceous-argillaceous beds and rhyolitic volcanic rocks of the Aillik Group of Early Proterozoic age. They include partially developed Kitts and Michelin deposits, containing 1560 and 7366 t U respectively. Uranium occurs mainly as disseminated fine pitchblende grains in lenticular concordant zones, and rarely as coarse pitchblende aggregates and thin veinlets. The occurrences in the argillaceous-tuffaceous beds, including the Kitts deposit, are within a steeply dipping stratigraphic zone less than 50 m thick and over 20 km long. They are interpreted as 'syngenetic', with a source of uranium in an active felsic volcanic field in adjacent terrain. The occurrences in the rhyolitic rocks, including the Michelin deposit, are in elongate structural-stratigraphic belts or zones, and are characterized by a pronounced enrichment of soda and depletion of potash associated with mineralization. They are interpreted as 'epigenetic', related closely in time to the felsic volcanism that formed the host rocks 1767+-4 Ma ago according to a Rb/Sr isochron date. The mineralized zones were affected to a varying degree by Hudsonian deformation and metamorphism. Some of the pitchblendes yielded nearly concordant dates close to 1750 Ma.

25269 (IAEA-TECDOC—315, pp 69-94) **Olympic Dam copper-uranium-gold deposit, Roxby Downs, South Australia.** Roberts, D.E.; Hudson, G.R.T. (Roxby Management Services Proprietary Ltd, Unley, SA (Australia)). Oct 1984. NTIS (US Sales Only), PC A15/MF A01. File Number DE85780873.

In Proterozoic unconformity and stratabound uranium deposits. Report of the working group on uranium geology organized by the IAEA.

The Olympic Dam copper-uranium-gold deposit in South Australia was discovered in 1975. It has an areal extent exceeding 20 km^2 with vertical thicknesses of mineralization up to 350 metres. The deposit is estimated to contain in excess of 2,000 million tonnes of mineralized material with an average grade of 1.6 percent

copper, 0.06 percent uranium oxides, and 0.6gm per tonne gold. The unmetamorphosed coarse clastic Proterozoic sediments hosting the mineralization are probably no older than 1580 Ma and appear to fill a graben in granitic rocks beneath 350m of unmineralized, flat lying Adelaidean to Cambrian sediments. Disseminated strata-bound bornite-chalcopyrite-pyrite is the dominant type of sulfide mineralization with lesser amounts of younger transgressive chalcocite-bornite. Uraninite, with lesser coffinite and brannerite occurs with the sulphide mineralization in a variety of textural forms and rare earths minerals bastnaesite and florencite occur in, and adjacent to sulphide mineralized zones. Gold and silver are a minor but significant component of the mineralization.

25270 (IAEA-TECDOC—315, pp 95-113) **Strata-bound uranium deposits in the Dripping Spring Quartzite, Gila County, Arizona, USA. A model for their formation.** Nutt, C.J. (Geological Survey, Denver, CO (USA)). Oct 1984. NTIS (US Sales Only), PC A15/MF A01. File Number DE85780873.

In Proterozoic unconformity and stratabound uranium deposits. Report of the working group on uranium geology organized by the IAEA.

Uranium deposits in the Proterozoic Dripping Spring Quartzite are stratabound in diagnetically altered, potassium-rich and carbonaceous volcanogenic siltstones. The deposits are localized near Proterozoic diabase intrusions and along monoclines that deform the essentially flat-lying sequence. Uraninite and coffinite are both in vertical veins and in sub-horizontal to horizontal veins along stylolites and bedding planes, and are disseminated in fine-grained, potassium-feldspar-rich layers. The uranium deposits in the Dripping Spring Quartzite are thought to be diagenetic/sedimentary concentrations that were later remobilized during diabase emplacement. Uranium, which may have been released from the volcanogenic sediments during diagenesis, could have been transported and concentrated in carbonaceous siltstones at the time of diagenesis and stylolite formation. Circulating fluids associated with diabase emplacement remobilized and concentrated uranium in carbonaceous siltstones close to diabase.

25271 (IAEA-TECDOC—315, pp 115-134) **Lianshanguan uranium deposit, Northeast China. Some petrological and geochemical constraints on genesis.** Zhong Jiarong; Guo Zhitian (Beijing Research Institute of Uranium Geology (China)). Oct 1984. NTIS (US Sales Only), PC A15/MF A01. File Number DE85780873.

In Proterozoic unconformity and stratabound uranium deposits. Report of the working group on uranium geology organized by the IAEA.

The Lianshanguan uranium deposits are located in the Liaoning Province of northeastern China. The deposits occur in a transitional zone lying between an Archaean craton and Lower Proterozoic miogeosynclinal sequences. Three types of uranium mineralisation are present in the area; syngenetic mineralisation occurs in the basal psammitic units of the Lower Proterozoic rocks which, during metamorphism in the period 1900 to 1800 Ma, was partly mobilised and concentrated in the metasediments. Late-orogenic granite emplacement in the Lower Proterozoic saw the development of uranium-bearing alkali solutions that initially produced metasomatic white migmatite in fracture zones marginal to the granites. Ore grades are relatively rich in these alkali hypo-meso metasomatic uranium deposits. With precipitation of potassium and sodium from the metasomatising solutions uranium became further enriched in the evolved fluids. Precipitation of uranium from these fluids produced meso-epithermal mineralisation of the fissure filling type. All three types of uranium mineralisation have been overprinted by tectonic movements associated with activation of the platform cover in the period 90 to 220 Ma.

25272 (IAEA-TECDOC—315, pp 135-205) **Pine Creek Geosyncline, N.T.** Ferguson, J. (ed.). Oct 1984. NTIS (US Sales Only), PC A15/MF A01. File Number DE85780873.

In Proterozoic unconformity and stratabound uranium deposits. Report of the working group on uranium geology organized by the IAEA.

The Pine Creek Geosyncline comprises about 14 km of chronostratigraphic mainly pelitic and psammitic Early Proterozoic sediments with interlayered tuff units, resting on granitic late Archaean complexes exposed as small domes. Sedimentation took place in one basin, and most stratigraphic units are represented throughout the basin. The sediments were regionally deformed and metamorphosed at 1800 Ma. Tightly folded greenschist facies strata in the centre grade into isoclinally deformed amphibolite facies metamorphics in the west and northeast, granulites are present in the extreme northeast. Pre and post-orogenic continental tholeiites, and post-orogenic granite diapirs intrude the Early Proterozoic metasediments, and the granites are surrounded by hornfels zones up to 10 km wide in the greenschist facies terrane. Cover rocks of Carpentarian (Middle Proterozoic) and younger ages rest on all these rocks unconformably and conceal the original basin margins. The uranium deposits post-date the approx. 1800 Ma regional metamorphic event; isotopic dating of uraninite and galena in the ore bodies indicates ages of mineralisation at approx. 1600 Ma, approx. 900 Ma and approx. 500 Ma. The ore bodies are stratabound, located within breccia zones, are of a shallow depth, and occur immediately below the Early/Middle Proterozoic unconformity.

25273 (IAEA-TECDOC—315, pp 207-217) **Uranium mineralization at Turee Creek, Western Australia.** Lustig, G.N.; Williams, C.R. (Pancontinental Mining Ltd., Sydney (Australia)); Ewers, G.R.; Ferguson, J. (Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia)). Oct 1984. NTIS (US Sales Only), PC A15/MF A01. File Number DE85780873.

In Proterozoic unconformity and stratabound uranium deposits. Report of the working group on uranium geology organized by the IAEA.

Uranium mineralisation which appears to be unconformity-related has been discovered at a contact between Middle Proterozoic sandstone and Early Proterozoic shale, greywacke, and dolomite in the Turee Creek area, W.A. The nature of this contact is controversial; it may represent a fault or an unconformity along which there has been minor movement. Although the mineralisation is still being evaluated and the ore controls have yet to be defined, a small uranium deposit consisting of approximately 643,000 tonnes grading 0.124% U_3O_8 has already been delineated. The mineralisation consists of uraninite, carnotite, phosphuranylite, and metatorbernite, and is hosted by clay zones, hematitic and/or carbonaceous shale and their brecciated equivalents, and chert breccias which form a sequence of uncertain age in the contact zone. Relationships are complex due to rapid facies changes within and between drill sections, and a tendency for units to pinch out along strike and down dip.

25274 (IAEA-TECDOC—315, pp 219-267) **Unconformity-related uranium deposits in the Athabasca Basin Region, Saskatchewan.** Ferguson, J. (ed.). Oct 1984. NTIS (US Sales Only), PC A15/MF A01. File Number DE85780873.

In Proterozoic unconformity and stratabound uranium deposits. Report of the working group on uranium geology organized by the IAEA.

Uranium deposits related to the sub-Athabasca unconformity contain large tonnages of high grade uranium resources. Their distribution is structurally and lithologically controlled by the unconformity, steep faults, pelitic rocks in the crystalline basement and clastic sedimentary rocks in the cover. The deposits contain monominerallic or polymetallic mineralizations, which are surrounded by alteration haloes. The deposits formed 1050 to 1300 Ma ago under hydrothermal conditions.

25275 (IAEA-TECDOC—315, pp 269-284) **Uranium geology Beaverlodge Area.** Ward, D.M. (Eldor Resources Ltd, Saskatoon, Saskatchewan (Canada)). Oct 1984. NTIS (US Sales Only), PC A15/MF A01. File Number DE85780873.

In Proterozoic unconformity and stratabound uranium deposits. Report of the working group on uranium geology organized by the IAEA.

A brief summary is presented of the geology of the Beaverlodge Area with particular emphasis placed on the uranium mining properties of Eldorado Resources Limited. The deformed metasedimentary and volcanic rocks within the area are of Aphebian and Helikian age. These rocks have undergone at least three periods of orogeny, namely, the Kenorian (approx. 2560 m.y.), Hudsonian (approx. 1750 m.y.) and Grenvillian (approx. 1000 m.y.). The final

phase of the Hudsonian Orogeny caused the activation of major faults with initial emplacement of epigenetic pitchblende deposits taking place and with probable widespread remobilisation during the Grenville Orogeny. Dates as recent as 200 m.y. have also been recorded for the uranium mineralisation. Genesis of the numerous uranium deposits in the Beaverlodge Area remains uncertain. It is generally considered that the deposits are related to metamorphic events and are the result of remobilisation within and from donor metasediments.

25276 (IAEA-TECDOC—315, pp 285-312) **Geology and discovery of proterozoic uranium deposits, Central District of Keewatin, Northwest Territories, Canada.** Ferguson, J. (ed.). Oct 1984. NTIS (US Sales Only), PC A15/MF A01. File Number DE85780873.

In Proterozoic unconformity and stratabound uranium deposits. Report of the working group on uranium geology organized by the IAEA.

Proterozoic supracrustal successions, Central District of Keewatin, are similar to the Proterozoic basins of northern Saskatchewan which contain economic uranium deposits. In this paper, examples of three of the more important uranium deposit types are described. Early Aphebian shallow marine pelitic to psammitic metasediments of the upper Amer group host subeconomic uranium concentrations. Late Aphebian structurally controlled depressions, Baker Lake Basin, Yathkyed Lake and Angikuni Lake subbasins, are filled with continental sediments and volcanics of the Dubawnt Group. Structurally controlled uranium mineralisation is most common adjacent to the margins of these basins. Conglomerate and sandstone of the Helikian Thelon Basin lie unconformably on a highly weathered basement complex. The Lone Gull deposit is hosted in retrograded and altered psammitic to pelitic metasediments and undeformed granite near the erosional edge of the basin. Mineralisation is structurally controlled and associated with zones of intense K- and Mg-metasomatism. These features parallel those of the unconformity-related deposits of N. Saskatchewan.

25277 (IAEA-TECDOC—315, pp 313-323) **Rio Preto uranium occurrences, Goias, Brazil.** Figueiredo Filho, P.M. de (NUCLEBRAS, Rio de Janeiro (Brazil)). Oct 1984. NTIS (US Sales Only), PC A15/MF A01. File Number DE85780873.

In Proterozoic unconformity and stratabound uranium deposits. Report of the working group on uranium geology organized by the IAEA.

The pre-Arai (+-1,200 Ma) discordance is interpreted as a surface from which uranium was leached from older (3,200-2,500 Ma) granites and gneisses, and transported by surface and ground waters. Prior to their metamorphism, the graphitic schists of the Ticunzal Formation possessed the oxi-reduction conditions necessary to fix the uranium available at that time. The Basal Complex consists of Archaean and lower Proterozoic rocks (3,200-2,500 Ma) including gneissic granites and orthogneisses. The Ticunzal Formation (2,000 Ma) which overlies the Basal Complex consists of paragneisses and biotite-muscovite graphite schists. The Basal complex and the Ticunzal Formation are in contact with granitic bodies, and together these underlie discordantly the metasediments of the Arai and Bambui groups which are likewise separated by a discordance. The Arai and Bambui groups are of Upper Proterozoic age and are sterile with respect to uranium.

25278 (IAEA-TECDOC—315, pp 325-338) **Proterozoic unconformity and strata-bound uranium deposits.** Ferguson, J. (Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia)). Oct 1984. NTIS (US Sales Only), PC A15/MF A01. File Number DE85780873.

In Proterozoic unconformity and stratabound uranium deposits. Report of the working group on uranium geology organized by the IAEA.

In the epilogue of the Report of the Working Group on Uranium Geology organized by the IAEA the diverse styles of uranium mineralization are summarized. The uranium deposits covered by this collection of papers are grouped into two main types: dominantly stratiform types or stratabound and unconformity-related types.

25279 (IAEA-TECDOC—315) **Proterozoic unconformity and stratabound uranium deposits. Report of the working groups on uranium geology organized by the IAEA.** Ferguson, J. (ed.). (International Atomic Energy Agency, Vienna (Austria)). Oct 1984. 342p. NTIS (US Sales Only), PC A15/MF A01. File Number DE85780873.

Individual sections are indexed.

0502 Exploration

25280 (PB—85-160794/XAB) **Effect of drilling fluids on permeability of uranium sandstone. Report of Investigations/1984.** Ahlness, J.K.; Johnson, D.I.; Tweeton, D.R. (Bureau of Mines, Twin Cities, MN (USA). Twin Cities Research Center). 1984. 23p. (BM-IC—8914). NTIS, PC A02/MF A01.

Library of Congress Catalog Card No. 84-600193.

The Bureau of Mines conducted laboratory and field experiments to determine the amount of permeability reduction in uranium sandstone after its exposure to different drilling fluids. Seven polymer and two bentonite fluids were laboratory-tested in their clean condition, and six polymer fluids were tested with simulated drill cuttings added. Sandstone cores cut from samples collected at an open pit uranium mine were the test medium. The clean fluid that resulted in the least permeability reduction was an hydroxyethyl cellulose polymer fluid. The greatest permeability reduction of the clean polymers came from a shale-inhibiting synthetic polymer. Six polymer fluids were tested with simulated drill cuttings added to represent field use. The least permeability reduction was obtained from a multi-polymer blend fluid. A field experiment was performed to compare how two polymer fluids affect formation permeability when used for drilling in situ uranium leaching wells.

0503 Mining

REFER ALSO TO CITATION(S) 25326, 26012, 26013, 26431, 26432

25281 (PB—85-152932/XAB) **Cost survey for radon daughter control by ventilation and other control techniques. Volume 1. Open file report, 30 September 1981-31 July 1984.** Bloomster, C.H.; Enderlin, W.I.; Young, J.K.; Dirks, J.A. (Battelle-Northwest, Richland, WA (USA). Pacific Northwest Lab.). Aug 1984. 235p. NTIS, PC A11/MF A01.

See also PB85-152940.

The costs of ventilation for underground uranium mines to meet the existing radiation exposure standard were estimated for 14 mines, representing over half of the underground uranium production in the United States. All of the mines used the room-and-pillar system of mining, all were in sedimentary formations, and mine depth ranged from 300 to 2,700 ft. Using the information obtained from the mines, the costs were estimated for meeting more stringent exposure standards using dilution ventilation only and other control methods in combination with dilution ventilation. A theoretical engineering analysis of the ventilation system requirements that would be needed in each mine to comply with the more stringent standards was performed. Projected costs for meeting the more stringent standards were based on the increased capital and operating costs of the higher capacity ventilation systems. Two mines were analyzed to determine the cost-effectiveness of other control methods (i.e., sealants, bulkheads, and filtration), in combination with dilution ventilations.

25282 (PB—85-152940/XAB) **Cost survey for radon daughter control by ventilation and other control techniques: radon emissions from underground uranium mines. Volume 2. Open file report, 30 September 1981-31 July 1984.** Bloomster, C.H.; Jackson, P.O.; Dirks, J.A.; Reis, J.W. (Battelle-Northwest, Richland, WA (USA). Pacific Northwest Lab.). Sep 1984. 102p. NTIS, PC A06/MF A01.

See also PB85-152932.

This study estimated (1) radon and radon daughter emissions from underground uranium mines; (2) the reduction in radon that would be released to the surface by using control techniques such as bulkheads, sealants, backfilling, and positive pressure ventilation;

(3) the cost for radon and radon daughter removal from total exhaust air; and (4) total radon and radon daughter discharge for lower occupational exposure limits. For 13 large underground uranium mines, estimated yearly radon emissions from each mine ranged from 900 to 3,400 Ci. The estimated age of air emitted from the mines ranged from 11 to 37 min. Potential radon removal methods for the total mine exhaust were evaluated. The cost of these methods was prohibitive. Diurnal and seasonal changes may affect radon emission over short periods of time, but do not affect the total emissions over the long run. Radon and radon daughter emissions would be little changed by increased ventilation requirements needed to achieve lower occupational exposure limits. The concentrations in the exhaust would be lower, but the total release would be the same.

0504 Feed Processing

REFER ALSO TO CITATION(S) 25327

25283 **(ERP/MSL—81-57) Chlorine-assisted leaching of Rabbit Lake uranium ore.** Haque, K.E. (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada)). May 1981. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700587.

Bench-scale chlorine-assisted leaching tests were conducted on the Rabbit Lake uranium ore. Maximum extractions of uranium (97%), and radium-226 (90%) were obtained from leach tests conducted on slurries containing 60% solids at 40 degree C for 18 hours of leaching. Chlorine requirement was found to be 25.0 kg/tonne of ore to maintain the acidity level of the leach slurry at pH 1.0. Hydrochloric acid leaches were conducted on the chlorine-assisted leach residue to reduce the radium level to 25 pCi/g from 140 pCi/g of solids, but the radium level of the second-stage leach residue was found to be 90 pCi/g of solids. Therefore multistage (3 or 4 stages) acid chloride leaching has been recommended to obtain tailings almost free of radionuclides.

25284 **(MRP/MSL—82-86) Preconcentration of a low grade uranium ore in CPDU and laboratory investigation to optimize the dewatering conditions of the preconcentration products.** Cristovici, M.A.; Berry, T.F.; Raicevic, M.M.; Brady, E.L.; Bredin, E.L.; Leigh, G.W.; Rouleau, J.P. (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario). Apr 1982. 173p. NTIS (US Sales Only), PC A08/MF A01. File Number DE85700588.

A process consisting of pyrite flotation and magnetic concentration of radionuclides was developed by CANMET over several years, to preconcentrate low grade uranium ores prior to leaching. When the economics of the preconcentration-leaching technology was compared with the leaching of the entire ore after pyrite flotation (Base Case variant), the preconcentration method appeared to be economically less advantageous than expected, due to the high cost of dewatering the preconcentration products. Further investigations examined in-depth the metallurgy and dewatering of the two variants: preconcentration and base case. A typical low grade uranium ore from Elliot Lake area was used. The metallurgy was compared based on data from continuous operation (CPDU). In the preconcentration variant the amount of ore directed to leaching was reduced to more than one third of that processed in the base case, while the radionuclide concentration became more than three times higher. However, by preconcentration 7% of the uranium was lost before leaching. Systematic laboratory-scale settling and filter tests optimized the dewatering conditions of the preconcentration technology to the extent that rates similar to those of the base case were obtained.

0505 Enrichment

25285 **(K/PS—5056) Technology for increasing the uranium-235 isotopic abundance in natural uranium feed on a productive scale.** Evans, E.C. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 19 Apr 1985. Contract AC05-84OT21400. 36p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85011252.

First, the uses of enriched uranium are discussed, then the technologies for enriching uranium, how these technologies are developed and applied, and the current and future supplies of enriched uranium compared to forecasts of demand are explained. 29 figs.

25286 **(UCRL—92089) EDS operator and control software.** Ott, L.L. (Lawrence Livermore National Lab., CA (USA)). Apr 1985. Contract W-7405-ENG-48. 24p. (CONF-8504108—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010470.

From Interex/HP-1000 Users conference; Antwerp, Belgium (15 Apr 1985).

The Enrichment Diagnostic System (EDS) was developed at Lawrence Livermore National Laboratory (LLNL) to acquire, display and analyze large quantities of transient data for a real-time Advanced Vapor Laser Isotope Separation (AVLIS) experiment. Major topics discussed in this paper are the EDS operator interface (SHELL) program, the data acquisition and analysis scheduling software, and the graphics software. The workstation concept used in EDS, the software used to configure a user's workstation, and the ownership and management of a diagnostic are described. An EDS diagnostic is a combination of hardware and software designed to study specific aspects of the process. Overall system performance is discussed from the standpoint of scheduling techniques, evaluation tools, optimization techniques, and program-to-program communication methods. EDS is based on a data driven design which keeps the need to modify software to a minimum. This design requires a fast and reliable data base management system. A third party data base management product, Berkeley Software System Database, written explicitly for HP1000's, is used for all EDS data bases. All graphics is done with an in-house graphics product, Device Independent Graphics Library (DIGLIB). Examples of devices supported by DIGLIB are: Versatec printer/plotters, Raster Technologies Graphic Display Controllers, and HP terminals (HP264x and HP262x). The benefits derived by using HP hardware and software as well as obstacles imposed by the HP environment are presented in relation to EDS development and implementation.

0507 Fuels Production And Properties

REFER ALSO TO CITATION(S) 25328, 25332, 25333, 25338, 25340, 25341, 25344, 25345, 25346, 25347, 25348, 25349, 25350, 25360

0508 Spent Fuels Reprocessing

REFER ALSO TO CITATION(S) 25575, 25908

25287 **(ORNL/TM—9584) Consolidated Fuel Reprocessing Program. Progress report, January 1-March 31, 1985.** (Oak Ridge National Lab., TN (USA)). Apr 1985. Contract AC05-84Ok21400. 41p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85010591.

The DOE has concentrated all US research and development on fuel reprocessing into one major program - the Consolidated Fuel Reprocessing Program (CFRP) - under the management of the Oak Ridge National Laboratory and the Oak Ridge Operations Office. Other major program participants are GA Technologies, Inc., where reprocessing research and development on the HTGR fuel cycle are done, and the Hanford Engineering Development Laboratory (HEDL). The coverage is generally overview in nature. Experimental details and data have been limited to (1) make the report more concise and (2) meet the requirements which would qualify the report for unrestricted distribution in the open literature. All research and development on civilian power reactor fuel reprocessing in the United States is managed under the Consolidated Fuel Reprocessing Program (CFRP) centered at Oak Ridge National Laboratory (ORNL). Technical progress is reported in overview fashion in this series of quarterly progress reports.

25288 (Zfl-Mitt—82, pp 5-85) **Chemistry of ruthenium in nitric acid solution with special regard to nuclear fuel solutions.** Foersterling, H.U. Nov 1983. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE85780872.

In Reports of the Central Institute for Isotopes and Radiation Research.

A review is given concerning the published knowledge about the chemistry of ruthenium in nitric acid solution with special reference to nitric acid nuclear fuel solutions. Possibilities of the spectroscopic description of the different existing ruthenium complexes are discussed and papers are presented dealing with the estimation of the proportions of the different ruthenium compounds in nuclear fuel solutions. Finally, arguments are derived for the preparation of ruthenium-containing model solutions, which adequately simulate the composition of real nuclear fuel solutions.

25289 (Zfl-Mitt—86, pp 69-96) **Extraction of nitric acid and fission products by means of organic phosphorus compounds.** Gorski, B.; Heilfort, G. Apr 1984. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE85780871.

In Reports of the Central Institute for Isotopes and Radiation Research.

The extraction of palladium and technetium with TBP, TOPO, and bidentate phosphonates from nitric acid solutions has been investigated considering the distribution of nitric acid in the organic phosphorus compounds.

0509 Transport And Storage

REFER ALSO TO CITATION(S) 25298, 25915, 25921, 25922

25290 (NUREG/CR—4035) **Highway accident involving radiopharmaceuticals near Brookhaven, Mississippi on December 3, 1983.** Mohr, P.B.; Mount, M.E.; Schwartz, M.W. (Lawrence Livermore National Lab., CA (USA)). Apr 1985. Contract W-7405-ENG-48. 48p. (UCRL—53587). NTIS, PC A03/MF A01 - GPO $4.00. File Number TI85010599.

A rear-end collision occurred between a passenger automobile and a luggage trailer carrying 84 packages, 76 of which contained radiopharmaceuticals, on US Highway 84 near Brookhaven, Mississippi on the afternoon of December 3, 1983. The purpose of this report is to document the mechanical circumstances of the accident, confirm the nature and quantity of radioactive materials involved, and assess the nature of the physical environment to which the packages were exposed and the response of the packages. The report consists of three major sections. The first deals wth the nature and circumstances of the accident and findings of fact. The second gives an accounting and description of the materials involved and the consequences of their exposure. The third gives an assessment and analysis of the mechanisms of damage and the conclusions which may be drawn from the investigation. 4 refs., 24 figs., 4 tabs.

25291 (NUREG/CR—4084) **Dry spent fuel storage test plan for destructive fuel rod examinations.** Olsen, C.S. (EG and G Idaho, Inc., Idaho Falls (USA)). Jan 1985. Contract AC07-76ID01570. 35p. (EGG—2367). NTIS, PC A03/MF A01 - GPO. File Number TI85010464.

A testing program using eight commercial pressurized water reactor and boiling water reactor spent fuel rods was conducted to investigate their long-term stability under a variety of possible dry storage conditions. The objective of this project is to provide the Nuclear Regulatory Commission with information to confirm or establish dry spent fuel storage licensing positions for long-term, low-temperature (<250°C) spent fuel rod behavior during dry storage and for radioactive contamination that might occur with spallation of cladding crud. Six of the eight commercial fuel rods will be destructively examined. This report presents the test plan for the destructive examinations.

25292 (PNL-SA—12464) **Materials considerations in interim storage of spent fuels.** Johnson, A.B. Jr.; Bailey, W.J.; Gilbert, E.R.; Oden, D.R. (Pacific Northwest Labs., Richland, WA (USA)). Nov 1984. Contract AC06-76RL01830. 13p. (CONF-850311—12). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010305.

From National Association of Corrosion Engineers annual meeting and materials performance and corrosion show; Boston, MA, USA (25 Mar 1985).

After reactor service, nuclear fuel from water-cooled reactors is discharged into water pools. Currently, the only licensed fuel management method in the USA is to leave the fuel in water storage until the Federal Government begins to receive the fuel in 1998. Dry storage has been licensed in several countries. A licensing position for dry storage is developing in the USA, to complement wet storage for utilities which expect to exceed wet storage capacities before the Federal Government accepts their fuel. This paper discusses materials aspects of the interim storage technologies. 37 refs., 1 fig., 2 tabs.

25293 (PNL-SA—12587) **Experimental program to determine maximum temperatures for dry storage of spent fuel.** Knox, C.A.; Gilbert, E.R.; White, G.D. (Pacific Northwest Labs., Richland, WA (USA)). Feb 1985. Contract AC06-76RL01830. 14p. (CONF-850314—57). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010307.

From Waste management '85; Tucson, AZ, USA (24 Mar 1985).

Although air is used as a cover gas in some dry storage facilities, other facilities use inert cover gases which must be monitored to assure inertness of the atmosphere. Thus qualifying air as a cover gas is attractive for the dry storage of spent fuels. At sufficiently high temperatures, air can react with spent fuel (UO_2) at the site of cladding breaches that formed during reactor irradiation or during dry storage. The reaction rate is temperature dependent; hence the rates can be maintained at acceptable levels if temperatures are low. Tests with spent fuel are being conducted at Pacific Northwest Laboratory (PNL) to determine the allowable temperatures for storage of spent fuel in air. Tests performed with nonirradiated UO_2 pellets indicated that moisture, surface condition, gamma radiation, gadolinia content of the fuel pellet, and temperature are important variables. Tests were then initiated on spent fuel to develop design data under simulated dry storage conditions. Tests have been conducted at 200 and 230°C on spent fuel in air and 275°C in moist nitrogen. The results for nonirradiated UO_2 and published data for irradiated fuel indicate that above 230°C, oxidation rates are unacceptably high for extended storage in air. The tests with spent fuel will be continued for approximately three years to enable reliable extrapolations to be made for extended storage in air and inert gases with oxidizing constituents. 6 refs., 6 figs., 3 tabs.

25294 (UCRL—92459) **Evaluation of current regulations and real accident conditions.** Fischer, L.E.; Kimura, C.Y.; Witte, M.C. (Lawrence Livermore National Lab., CA (USA)). 5 Apr 1985. Contract W-7405-ENG-48. 27p. (CONF-850314—59). NTIS, PC A03/MF A01 - GPO. File Number TI85010479.

From Waste management '85; Tucson, AZ, USA (24 Mar 1985).

In order to improve estimates of the effectiveness of current regulatory standards, a program was initiated by the US Nuclear Regulatory Commission (NRC) to have the Lawrence Livermore Laboratory (LLNL) evaluate regulatory standards against real world accident conditions. This paper presents the results of the evaluation performed for the hypothetical 30-foot drop onto an unyielding surface and real world impact conditions which might be experienced by a spent fuel cask being transported by a truck. The results of the evaluations performed for other pertinent accident conditions for truck and train transport will be documented at the conclusion of the program. 10 refs., 8 figs., 3 tabs.

0510 Marketing And Economics

REFER ALSO TO CITATION(S) 25298

0520 Waste Management

REFER ALSO TO CITATION(S) 25320, 25322, 25323, 25324, 25325, 25862, 25879, 25880, 26016, 26226, 26227, 26228, 26229, 26234, 26235, 26236, 26237, 26238, 26239, 26240, 26241, 26245, 26250, 26255

25295 (DOE/ER/10275—1A, pp 1, Paper 3) **Thermal gradient migration of brine inclusions in salt.** Yagnik, S.K. (Univ. of California, Berkeley). 1982. NTIS, PC A03/MF A01. File Number DE83004080. (CONF-820359—Absts.).

From Western regional American Nuclear Society student conference; Corvallis, OR, USA (28 Mar 1982).

It has been proposed that the high level nuclear wastes be buried deep underground in a suitable geologic formation such as natural salt. Natural salt deposits, however, are known to contain a small amount (~ 0.5 vol %) of water in the form of brine inclusions which are dispersed throughout the salt deposits. These brine inclusions will be mobilized by the temperature gradients imposed by the heat generating nuclear wastes. Therefore, it is important to know the rate and the amount of brine accumulating at the waste packages to properly evaluate the performance of a nuclear waste repository. An experimental investigation was conducted to study the migration of brine inclusions in synthetic single crystals of salt and in natural polycrystalline salt samples. An optical microscope attachment capable of simultaneously imposing a temperature gradient and a compressive axial load to the salt samples was used for this purpose. The migration velocities of all-liquid and gas-liquid inclusions were measured as a function of temperature, temperature gradient and applied axial lead. It was found that the solid liquid interfacial kinetics are important in the migration mechanism. The interfacial kinetics are non-linear at low loads and linear at high loads (~ 4 MPa). Behavior of both types of inclusion at a large angle grain boundary in natural salt was observed. Due to optical limitations of the microscopic hot-stage, a radioactive tracer technique is used for migration studies in the natural salt samples.

25296 (DOE/ER/10275—1A, pp 1, Paper 9) **Incineration as a low-level radioactive waste disposal alternative for the very low level (~ 200 mCi/yr) institutional waste generator.** Miller, S.D. (Arizona State Univ., Tempe). 1982. NTIS, PC A03/MF A01. File Number DE83004080. (CONF-820359—Absts.).

From Western regional American Nuclear Society student conference; Corvallis, OR, USA (28 Mar 1982).

As a result of increased shipping costs and decreased land availability, serious questions have arisen regarding the continued use of shallow land burial for disposal of institutional radioactive wastes. These factors are of special significance to very low-level waste generators such as Arizona State University whose most recent waste shipment averaged approximately 2 mCi per shipped barrel at an effective cost of over $100 per mCi disposed - a total cost of over $14,000. Recent studies have shown incineration to be an attractive waste disposal alternative both in terms of volume reduction of waste, and in its expected insignificant radiological and environmental impact. Arizona State University has purchased an incinerator and has initiated a program to incinerate radioactive wastes. Licensing restrictions involving stack monitoring for a variety of possibly hazardous effluents and 10CFR20 restrictions affecting incineration of certain isotopes could render the change to incineration completely inefficient unless accompanied by a rigorous program of waste segregation designed to ease licensing restrictions. This paper reviews incinerator technology as it applies to radioactive waste management and presents the analysis performed during the licensing phase, along with some of the difficulties inherent in the development process.

25297 **(DOE/ID/12576—T2) Generic host state incentive report. Draft.** (ERM-McGlennon Associates, Boston, MA (USA)). 26 Apr 1985. Contract FG07-85ID12576. 43p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85010840.

Even the most carefully designed and operated low-level radioactive waste management facility will present potential risks and costs to nearby residents. Individuals who live near these facilities may receive some benefits, but they also bear the brunt of any adverse impacts. It is with this in mind that various siting techniques have been developed. Before any "extra" compensation or incentive can be discussed, however, it must first be clearly demonstrated that these facilities protect public health and the environment. This report addresses five distinct areas as follows: mitigation measure to prevent or reduce the impact of the facility; incentives and compensation techniques that might make a facility more acceptable; the use of agreement building in order to develop an arrangement between the host community and a facility proponent; the importance of economics resulting from a typical regional low-level radioactive waste facility; and the role of state government in promoting and legitimizing the use of incentives. 6 tabs.

25298 **(DOE/RW—0024) Analysis of the total system life cycle cost for the Civilian Radioactive Waste Management Program.** (USDOE Office of Civilian Radioactive Waste Management, Washington, DC). Apr 1985. 223p. NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE85011220.

The total system life cycle cost (TSLCC) analysis for the Department of Energy's (DOE) Civilian Radioactive Waste Management Program is an ongoing activity that helps determine whether the revenue-producing mechanism established by the Nuclear Waste Policy Act of 1982 - a fee levied on the producers of nuclear power - is sufficient to cover the cost of the program. This report is an input into the third evaluation of the adequacy of the fee. The total-system cost for the reference waste-management program in this analysis is estimated to be 24 and 30 billion (1984) dollars. For the sensitivity cases studied in this report, the costs could be as high as 35 billion dollars and as low as 21 billion dollars. Because factors like repository location, the quantity of waste generated, transportation-cask technology, and repository startup dates exert substantial impacts on total-system costs, there are several tradeoffs between these factors, and these tradeoffs can greatly influence the total cost of the program. The total-system cost for the reference program described in this report is higher by 3 to 5 billion dollars, or 15 to 20%, than the cost for the reference program of the TSLCC analysis of April 1984. More than two-thirds of this increase is in the cost of repository construction and operation. These repository costs have increased because of changing design concepts, different assumptions about the effort required to perform the necessary activities, and a change in the source data on which the earlier analysis was based. Development and evaluation costs have similarly increased because of a net addition to the work content. Transportation costs have increased because of different assumptions about repository locations and several characteristics of the transportation system.

25299 **(EGG-PBS—6844) Technical evaluation of the ATI volume reduction and bitumen solidification topical report.** Henscheid, J.W.; Young, T.E. (EG and G Idaho, Inc., Idaho Falls (USA)). 5 Apr 1985. Contract AC07-76ID01570. 12p. NTIS, PC A02/MF A01 - GPO. File Number TI85011255.

This report summarizes EG & G Idaho's review of the Associated Technologies Inorporated (ATI) topical report on a Volume Reduction and Bitumen Solidification System. The review evaluated compliance with pertinent codes, standards and regulations. The initial review was discussed with ATI, and all outstanding issues resolved before this final evaluation was made.

25300 **(LA—10154-PR) Research and development related to the Nevada Nuclear Waste Storage Investigations. Progress report, January 1-March 31, 1984.** Crowe, B.M.; Vaniman, D.T. (comps.). (Los Alamos National Lab., NM (USA)). Feb 1985. Contract W-7405-ENG-36. 126p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE85010319.

This report summarizes the study of the geochemistry and mineralogy/petrology of Yucca Mountain completed in the period January 1 to March 31, 1984. Many rocks in Yucca Mountain have properties that will retard the transport of any radionuclides that

might be released from the waste package. The mineralogy/petrology program will provide a description of rock and fracture-fill petrology and mineralogy in the host rock and along the transport pathways to the accessible environment. The geochemistry program will quantify the extent of the interactions of radionuclides with the hydrogeological system. These programs provide the basis for a reliable assessment of the rate of transport of radionuclides from the repository to the accessible environment. The program is defined in terms of 10 tasks: groundwater chemistry, natural isotope chemistry, hydrothermal geochemistry, solubility determination, sorption and precipitation, dynamic transport processes, retardation sensitivity analysis, applied diffusion, mineralogy/petrology, and quality assurance. Three closely related projects also being conducted at Los Alamos are hazard assessment of future volcanism, the evaluation of various materials for sealing the entrance holes to the repository, and a study of the response of Yucca Mountain rocks to stress under hydrothermal conditions. 42 refs., 4 figs., 28 tabs.

25301 **(NUREG/CR—4101) Assay of long-lived radionuclides in low-level wastes from power reactors.** Cline, J.E.; Noyce, J.R.; Coe, L.J.; Wright, K.W. (Science Applications International Corp., Rockville, MD (USA)). Apr 1985. 614p. NTIS, PC A99/MF A01 - GPO $11.00. File Number TI85901372.

The 10 CFR Part 61 waste classification system includes several nuclides which are difficult to assay without expensive radiochemical methods. In order for waste generators to classify wastes practically, NRC Staff has recommended the use of correlation factors to scale the difficult-to-measure nuclides with nuclides which can be measured more easily (i.e., gamma emitters such as ^{60}Co or ^{137}Cs). In this study, Science Applications International Corporation (SAIC) performed complete radiochemical assays for all the 10 CFR Part 61 waste classification nuclides on over 100 samples. These data, along with almost 800 other samples in the SAIC data base, were used to assess the validity of correlation factors suggested for use in nuclear power plant wastes. Specific generic correlation factors are recommended with other approaches to correlate nuclides for which generic scaling factors are not defensible. The primary nuclide correlations studied were ^{14}C, ^{55}Fe, ^{59}Ni, ^{63}Ni, and ^{94}Nb, with ^{60}Co; ^{90}Sr, ^{99}Tc, ^{129}I, ^{135}Cs, and /sup 239, 240/Pu with ^{137}Cs; ^{238}Pu, /sup 239, 240/Pu, ^{241}Pu, ^{241}Am, ^{243}Cm, and / sup 243, 244/Cm with ^{144}Ce; and ^{238}Pu, ^{241}Pu, ^{241}Am, ^{243}Cm and / sup 243, 244/Cm with /sup 239, 240/Pu.

25302 **(NUREG/CR—4181) Leachability of radionuclides from cement solidified waste forms produced at operating nuclear power plants.** Croney, S.T. (EG and G Idaho, Inc., Idaho Falls (USA)). Mar 1985. Contract AC07-76ID01570. 125p. (EGG—2355). NTIS, PC A06/MF A01 - GPO. File Number TI85010918.

This study determined the leachability indexes of radionuclides contained in solidified liquid wastes from operating nuclear power plants. Different sizes of samples of cement-solidified liquid wastes were collected from two nuclear power plants - a pressurized water reactor and a boiling water reactor - to correlate radionuclide leaching from small- and full-sized (55-gallon) waste forms. Diffusion-based model analysis (ANS 16.1) of measured radionuclide leach data from both small- and full-sized samples was performed and indicate that leach data from small samples can be used to determine leachability indexes for full-sizes waste forms. The leachability indexes for cesium, strontium, and cobalt isotopes were determined for waste samples from both plants according to the models used for ANS 16.1. The leachability indexes for the pressurized water reactor samples were 6.4 for cesium, 7.1 for strontium, and 10.4 for cobalt. Leachability indexes for the boiling water reactor samples were 6.5 for cesium, 8.6 for strontium, and 11.1 for cobalt.

25303 **(PB—85-159002/XAB) Directory of computer programs for assessment of radioactive waste disposal in geological formations. Final report.** Broyd, T.W.; Dean, R.B.; Hobbs, G.D.; Knowles, N.C.; Putney, J.M. (Commission of the European Communities, Luxembourg). [1985]. 471p. (EUR—8669-EN). NTIS, PC E15/MF E01.

This directory describes computer programs suitable for the assessment of radioactive waste disposal facilities in geological formations. The programs, which are mainly applicable to the post closure analysis of the repository, address combinations of the following topics: nuclide inventory, corrosion, leaching, geochemistry, stress analysis, heat transfer, groundwater flow and radionuclide transport. Biosphere modelling, surface water flow and risk analysis are not covered. A total of 248 programs are identified, of which 50 are reviewed in detail, 134 in summary and 64 in tabular fashion. The Directory has been compiled using a combination of literature searches, correspondence and meetings with recognized experts. It differs from previous reviews of computer programs for similar topic areas in two main respects. Firstly, the method of obtaining information has resulted in program descriptions of considerable breadth and detail. Secondly, the Directory has concentrated wherever possible on European (instead of North American) codes.

25304 **(PB—85-164150/XAB) Benthic boundary layer - IOS (Institute of Oceanographic Sciences) observational programme: Discovery Gap measurements, March 1984.** Saunders, P.M. (Institute of Oceanographic Sciences, Godalming (UK)). 1984. 45p. NTIS, PC E04/MF E01.

A narrow gap in the East Azores Fracture Zone provides a channel for the exchange of the bottom water between the Madeira and Iberian abyssal basins. It is named Discovery Gap and a detailed survey defines its length, morphology and sills. Year-long measurements of flow are made from six moorings and ten current meters. This data is supplemented by numerous measurements of temperature made from ship-lowered instruments.

25305 **(PB—85-164176/XAB) Use of in situ photography in studies of the deep-sea benthos at IOS (Institute of Oceanographic Sciences).** Lampitt, R.S.; Rice, A.L.; Thurston, M.H. (Institute of Oceanographic Sciences, Godalming (UK)). 1984. 40p. NTIS, PC E04/MF E01.

Photography has been a part of benthic biology studies at IOS since 1975. It has been used in several modes and as an adjunct to a number of other techniques. A substantial body of valuable data has been obtained about the abundance, distribution, and behaviour of deep sea species, about seasonal changes of the sea floor and about the rates of some fundamental biological processes. Most of the data could not have been obtained using any other technique.

25306 **(PB—85-164184/XAB) Measurements of sediment temperatures, conductivity, and heat flow in the North Atlantic and their relevance to radioactive waste disposal.** Noel, M.J. (Institute of Oceanographic Sciences, Godalming (UK)). 1984. 93p. NTIS, PC E06/MF E01.

This report describes the methods which were used to measure sediment temperatures, conductivity and heat flow at ten stations in the northeast Atlantic. These have yielded data from a total of 53 individual penetrations. Surface heat fluxes are compared to the values predicted by crustal cooling models while sediment temperature profiles are examined for evidence of vertical pore water advection. No thermal evidence was found for advection through sediments in the Great Meteor East study area. However, nonlinear temperature profiles may be evidence for rapid pore water advection at several locations within the King's Trough Flank study region. These results are critically assessed in terms of other factors that may give rise to the observed nonlinear temperature profiles.

25307 **(PNL—5173) Management of low-level radioactive wastes around the world.** Lakey, L.T.; Harmon, K.M.; Colombo, P. (Pacific Northwest Labs., Richland, WA (USA)). Apr 1985. Contract AC06-76RL01830. 72p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85011219.

This paper reviews the status of various practices used throughout the world for managing low-level radioactive wastes. Most of the information in this review was obtained through the DOE-sponsored International Program Support Office (IPSO) activities at Pacific Northwest Laboratory (PNL) at Richland, Washington. The objective of IPSO is to collect, evaluate, and disseminate information on international waste management and nuclear fuel cycle activities. The center's sources of information vary widely and include the proceedings of international symposia, papers presented at technical society meetings, published topical reports, foreign trip reports, and the news media. Periodically, the in-

formation is published in topical reports. Much of the information contained in this report was presented at the Fifth Annual Participants' Information Meeting sponsored by DOE's Low-Level Waste Management Program Office at Denver, Colorado, in September of 1983. Subsequent to that presentation, the information has been updated, particularly with information provided by Dr. P. Colombo of Brookhaven National Laboratory who corresponded with low-level waste management specialists in many countries. The practices reviewed in this paper generally represent actual operations. However, major R and D activities, along with future plans, are also discussed. 98 refs., 6 tabls.

25308 **(PNL-SA—12509) Development of HWVP melter/turntable components for canyon-remote maintenance and replacement.** Siemens, D.H.; Beary, M.M.; Berger, D.N.; Heath, W.O.; Larson, D.E. (Pacific Northwest Labs., Richland, WA (USA)). Mar 1985. Contract AC06-76RL01830. 12p. (CONF-850314—58). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010308.

From Waste management '85; Tucson, AZ, USA (24 Mar 1985).

Remote operability and maintainability of vitrification equipment were assessed under shielded-cell conditions. The equipment tested will be applied to immobilize high-level and transuranic liquid waste slurries that resulted from plutonium production for defense weapons. Equipment tested included: (1) a turntable for handling waste canisters under the melter; (2) a removable discharge cone in the melter overflow section; (3) a thermocouple jumper that extends into a shielded cell; (4) remote instrument and electrical connectors; (5) remote, mechanical, and heat transfer aspects of the melter glass overflow section; (6) a reamer to clean out plugged nozzles in the melter top; (7) a closed circuit camera to view the melter interior; and (8) a device to retrieve samples of the glass product. 14 figs.

25309 **(RHO-BW-SA—398AP) Reference data source documentation for performance assessment studies, Basalt Waste Isolation Project, Hanford Site, Washington.** Way, S.C.; Koenig, R.A.; Loo, W.W. (In-Situ, Inc., Laramie, WY (USA); Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). Oct 1984. Contract AC06-77RL01030. 68p. (CONF-850151—3; RHO-BW-SA—398P). NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85010543.

From National Water Well Association Western Regional ground water conference; Reno, NV, USA (15 Jan 1985).

The National Waste Terminal Storage (NWTS) Program was initiated by the United States in the mid-1970's to investigate the feasibility of storing nuclear waste in deep geologic formations. The Basalt Waste Isolation Project (BWIP) is one of the major research and development projects under the direction of the NWTS program. Rockwell Hanford Operations is presently responsible for investigating the feasibility of siting a repository or terminal disposal of nuclear waste in the basalts underlying the Hanford Site. Whether or not this site - or any site - is ultimately suitable for the purpose must be based on computer-generated predictions of long-term repository performance. Computer modeling requires the quantitative specification of a large number of parameters that characterize the properties of the three principal repository subsystems (Site, Repository Seals, and Waste Package). The acceptance of conclusions (drawn from predictive models) by the public, the scientific community at large, and the regulatory and review agencies depends in part on the existence of a well-documented performance assessment data base that they can scrutinize and review. The parameter values compiled here constitute a listing of pertinent data currently in use for performance assessment. A computerized data storage and retrieval system was set up to handle the large amount of information collected to date and the projected future availability of additional information.

25310 **(RHO-HS-SR—84-2-4QGAS-P) Radioactivity in gaseous waste discharged from the separations facilities during 1984.** Aldrich, R.C.; Stanfield, L.J. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). 28 Feb 1985. Contract AC06-77RL01030. 61p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85011373.

This document summarizes the radioactivity in gaseous wastes discharged by Rockwell Hanford Operations (Rockwell) during CY 1984. During CY 1984, 77 stacks discharged gases which were normally contaminated or potentially contaminated with radioactive material. No air concentrations resulting from 200 Area effluents were above or even near DOE requirements. Also, all stack emissions were below Rockwell administrative controls based on the As Low As Reasonably Achievable philosophy. Discharge measurements showed that 100% of the total alpha activity was discharged by the following stacks: 291-A-1 (98%), 291-Z-1 (1%) and 291-T-1 (1%). Additionally, 99% of all the total particulate beta activity was discharged by 2 stacks: 291-A-1 (98%) and 291-B-1 (1%).

25311 **(SAND—84-1748C) Retrieval of spent fuel from a repository in tuff.** Flores, R.J. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 18p. (CONF-850314—54). NTIS, PC A02/MF A01; GPO Dep. File Number DE85009835.

From Waste management '85; Tucson, AZ, USA (24 Mar 1985).

In accordance with the Nuclear Waste Policy Act (NWPA) of 1982, federal agencies have developed regulations to ensure that nuclear waste disposal operations will not endanger the public health and safety or the environment. Included in these regulations is the requirement to preserve, as an added measure of assurance, the option to retrieve emplaced spent fuel. Consequently, a repository design must include retrieval as a planned contingency. The Nevada Nuclear Waste Storage Investigations (NNWSI) project is investigating the feasibility of locating a radioactive waste repository in the tuff formations at Yucca Mountain in southern Nevada. The target horizon is located in the unsaturated zone at an approximate average depth of 300 m below the surface in a formation of welded tuff. Two options are currently being considered for emplacement of waste packages: horizontal and vertical. In the vertical emplacement option, a single package is emplaced in a 7.6-m-deep vertical hole drilled in the floor of the underground rooms. In the horizontal emplacement option, up to 35 canisters are emplaced in a horizontal borehole that is drilled into the side of the underground room. The horizontal boreholes are up to 200 m long. Both options require unique equipment and operations to fulfil the retrievability requirement. A retrieval plan is being developed to support the repository design for Yucca mountain. This plan will be developed together with the development of conceptual design criteria for surface facilities, underground configurations, and waste-handling equipment. 13 refs., 3 figs.

25312 **(SAND—84-2126C) Use of field data to evaluate and improve drift response models for the Waste Isolation Pilot Plant (WIPP).** Morgan, H.S.; Stone, C.M.; Krieg, R.D. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 9p. (CONF-850671—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85007003.

From 26. U.S. symposium on rock mechanics; Rapid City, SD, USA (26 Jun 1985).

The Waste Isolation Pilot Plant (WIPP) is currently being excavated near Carlsbad, New Mexico by the US Department of Energy as a research and development facility to demonstrate the safe disposal of defense generated radioactive waste in bedded salt. Structural response data collected from underground rooms and drifts at the WIPP will ultimately be used to evaluate and improve computational models for predicting time-dependent room deformations caused by salt creep. An initial evaluation, based on a comparison of computed and measured room closures for one of the early WIPP excavations known as the South Drift, has already been completed. Some of the highlights of that evaluation are presented. First the finite element model used to compute the response of the South Drift is described. Then closure measurements from the South Drift are presented, and comparisons with the calculations are made. Attempts to resolve the resulting discrepancies are summarized next, and finally some directions for future work are offered. 7 figs.

25313 **(SAND—84-2547C) Source-term considerations for a potential radioactive-waste repository located in unsaturated tuff.** Braithwaite, J.W.; Tierney, M.S. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 12p. (CONF-8411160—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010090.

From Workshop on the source term for radionuclide migration from HLW or spent nuclear fuel; Albuquerque, NM, USA (13 Nov 1984).

The Nevada Nuclear Waste Storage Investigations project is studying the feasibility of locating a repository for high-level radioactive waste in the unsaturated tuffs at Yucca Mountain near the southwest part of the Nevada Test Site. An important part of these studies is the formulation of physically appropriate source terms for use in mathematical models used to assess the performance of the potential repository. Performance assessments conducted to date have used a preliminary source term based on simple assumptions and currently available data; this source term is described, along with the results of a sensitivity study that show the important parameters affecting the time-dependent radionuclide release rates. 7 refs., 2 figs., 1 tab.

25314 **(SAND—85-0801C) Subseabed disposal of high-level radioactive waste.** Gomez, L.S. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 20p. (CONF-850419—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85009838.

From 21. annual meeting of the National Council on Radiation Protection and Measurements; Washington, DC, USA (3 Apr 1985).

The principal goal of the US Subseabed Disposal Program is to assess the scientific feasibility of disposing of high-level nuclear waste in deep-sea sediments. Studies of disposal methods and of the barriers to radionuclide migration (canister, waste form and sediment) suggest that environmental data will be needed to address the impact of an accidental release of radionuclides in the deep sea upon man and other biota. The interactions of physical, geochemical and biological processes as they relate to radionuclide transport in the open ocean are being studied. In addition to the United States, a number of other countries are investigating the subseabed alternative to land-based waste disposal. This research is being coordinated by the Nuclear Energy Agency of the Organization of Economic Cooperation and Development. 25 refs.

25315 **(UCID—20289) Preliminary evaluation of alterant geophysical tomography in welded tuff.** Ramirez, A.L.; Daily, W.D. (Lawrence Livermore National Lab., CA (USA)). Dec 1984. Contract W-7405-ENG-48. 43p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85010826.

In-situ electromagnetic measurements have been performed at 300 MHz to evaluate the applicability of alterant geophysical tomography to delineate flow paths in a welded tuff rock mass. The measurements were made before, during and after a water-based tracer flowed through the rock mass. Alterant geophysical tomographs are compared with independent evidence - borescope logs, neutron logs and dyed rock samples. Anomalies imaged in the tomograph match fractures mapped with the borescope. The location of tracer-stained fractures coincides with the location of some image anomalies; other geophysical anomalies exist where tracer-stained fractures were not observed, perhaps due to poor core recovery. Consequently, a conclusive evaluation of the technique's effectiveness is not possible at present. Additional work is planned to conclusively evaluate the capabilities of alterant geophysical tomography in an environment similar to the Waste Package Environment Tests expected in Yucca Mountain. 17 refs., 10 figs.

25316 **(USGS-OFR—84-777) Handtc: a FORTRAN program to calculate inner-zone terrain corrections.** Spielman, J.B.; Ponce, D.A. (Geological Survey, Menlo Park, CA (USA)). 1984. Contract AI08-78ET44802. 24p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85011196.

FORTRAN program "Handtc" computes inner-zone terrain corrections for Hayford-Bowie zones C through F and Hammer zones D through H. The terrain corrections are based on the formula for the gravitational attraction of a vertical cylinder. The input file consists of four record types: a station record, a zone label record, a compartment elevation record, and a blank record. The program generates two files: an output file and a print file. The output file lists the station name, total terrain correction, and the various zone terrain corrections in integer format. The print file lists the station name, station elevation, units, method, zone labels, compartment elevations, terrain corrections for each compartment, terrain correction for each zone, and the total terrain correction. The format of the print file is such that it can be quickly scanned and compared to the input file to check for errors in format, zone labels, compartment elevations, or anomalous terrain corrections. The program was developed on a Digital VAX/VMS 11/750 computer and is compatible with ANSI Standard FORTRAN-77. 4 refs., 5 figs., 4 tabs.

25317 **(USGS/WRI—82-4118) Geologic and well-construction data for the H-8 borehole complex near the proposed Waste Isolation Pilot Plant Site, southeastern New Mexico.** Wells, J.G.; Drellack, S.L. Jr. (Geological Survey, Albuquerque, NM (USA)). 1982. Contract AI08-76DP00474. 52p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85010116.

The H-8 borehole complex, a group of three closely spaced boreholes, is located 9 miles south of the proposed Waste Isolation Pilot Plant site in southeastern Eddy County, New Mexico. The holes were drilled during July, August, and September 1979 to obtain geologic and hydrologic data to better define the regional ground-water-flow system. The geologic data presented in this report are part of a site-characterization study for the possible disposal of defense-associated radioactive wastes within salt beds of the Salado Formation of Permian age. The geologic data include detailed descriptions of cores, cuttings, and geophysical logs. Each borehole was designed to penetrate a distinct water-bearing zone: H-8a (total depth 505 feet) was completed just below the Magenta Dolomite Member of the Rustler Formation of Permian age; H-8b (total depth 624 feet) was completed just below the Culebra Dolomite Member of the Rustler Formation; and H-8c (total depth 808 feet) was completed just below the Rustler Formation-Salado Formation contact. The geologic units penetrated in borehole H-8c are surficial alluvium and eolian sand of Holocene age (0-4 feet); the Mescalero caliche (4-10 feet) and Gatuna Formation (10-153 feet), both of Pleistocene age; and the Dewey Lake Red Beds (153-399 feet), the Rustler Formation (399-733 feet), and part of the Salado Formation (733-808 feet), all of Permian age. The upper 41 feet of the Salado Formation penetrated by borehole H-8c is composed of residue from dissolution of halite and associated rocks and the hydration of anhydrite to gypsum, indicating that the eastward-moving dissolution on top of the Salado, found west of the WIPP site, has reached the H-8 site. 11 refs., 2 figs., 7 tabs.

25318 **(RHO-HS-SR—84-3-4Q-LIQ-P) Radioactive liquid wastes discharged to ground in the 200 areas during 1984.** Aldrich, R.C. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). 6 Mar 1985. Contract AC06-77RL01030. 164p. NTIS MF A01; 2; GPO Dep. File Number DE85010819.

This document summarizes radioactive liquids discharged to the ground in the 200 Areas of the Hanford Site. There are twenty-eight liquid discharge streams in the 200 Areas excluding sanitary sewers. Two of the streams, the cooling water discharge and the process condensate discharge from the 242-S Evaporator, were not used in 1984. Twenty-two streams were normally or potentially contaminated with radioactive material. Three streams had no potential for contamination, but are included in this report to maintain an accurate record of the total volume of liquid discharged to each disposal site. One stream, the PUREX Process Condensate, exceeded the regulation in DOE-Richland Office Order 5820.2 for transuranics in liquid discharges by 1.9 times on an annual average even though the source of the emission was corrected in May. No other stream exceeded any DOE regulations or Rockwell Hanford Operations (Rockwell) administrative controls. The principal sources of alpha-emitting radionuclides were the PUREX Process Condensate and the Z-Plant Waste Water at 69% and 25% of the total emission, respectively. The main sources of beta-emitting radionuclides were the B-Plant Process Condensate, the PUREX Ammonia Scrubber, and the PUREX Process Condensate at 61%, 24%, and 9% of the total emission, respectively. The largest source of tritium

was the PUREX Process Condensate at 93% of the total emission. Two new disposal sites, both cribs, were activated during 1984. The 216-S-26 crib receives waste water from the 222-S Laboratory, and the 216-U-16 crib receives both steam condensate and yard drain water from the U03 plant.

25319 **Rock mechanics considerations in the WIPP room design.** Harrington, T.J.; Chabannes, C.R.; Shukla, D.K. (Canonie Environmental Services, Inc., Chesterton, IN). pp 681-696 of Mechanical behavior of salt. Hardy, H.R. Jr.; Langer, M. (eds.). Clausthal, Germany, F.R.; Trans Tech Publications (1984). (CONF-811131—).

From 1. conference on the mechanical behavior of salt; University Park, PA, USA (9 Nov 1981).

An analysis of the Waste Isolation Pilot Plant (WIPP) room geometry at about 650 meter (2100 feet) under isothermal conditions was performed. The analysis evaluated the stability of the room design over a ten year period. The presence of stiff anhydrite layers and clay seams, as determined from field investigations, was evaluated. The clay seams were treated as joints in the model with the influence of the joint properties evaluated parametrically. The results indicate that the behavior of the room is governed by the locations and properties of the clay seams and stiff anhydrite layers. Hence, for the design of actual mine rooms which are required to remain open for a number of years, the determination of the exact local geology and the properties of the clay seams or joints and other interbeds is of prime importance.

0530 Environmental Aspects

REFER ALSO TO CITATION(S) 25313, 25314, 25880, 26084, 26255

25320 **(AECL—8371) Hydrothermal flow-through apparatus to simulate leaching of nuclear waste forms under quasi-dynamic conditions.** Heimann, R.B. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Mar 1985. 45p. Scientific Document Distribution Office-AECL, Chalk River, Ontario, Canada $4.00. File Number TI85901265.

Work performed under Canada/US Waste Management Information Exchange Agreement.

A hydrothermal flow-through apparatus has been designed that will allow the testing of individual waste package components, as well as combinations of these, under a wide range of environmental conditions. The maximum permissible temperature is 700°C, while the maximum pressure is 300 MPa. Flow rates can be adjusted by sequential operation of a pneumatically operated valve with preset pause and working cycles. The main applications of the apparatus to nuclear fuel waste management research are: the study of migration of ionic species through a rock column at specified hydraulic head; and the study of the rate of leaching of radionuclides from waste forms under disposal vault conditions in the presence of groundwater with variable flow rates. 21 figs., 2 tabs.

25321 **(CONF-850314—53) Environmental assessment process needs and future directions.** Gustafson, P.F. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010493.

From Waste management '85; Tucson, AZ, USA (24 Mar 1985).

The environmental assessment process as legislatively mandated by the National Environmental Policy Act of 1969 (NEPA) constitutes a double-edged sword as regards the successful management and disposal of radioactive waste. On the one hand, NEPA requires identification and disclosure of the environmental and societal consequences of a given major federal action, consideration of alternatives and/or mitigative measures leading to the same end result, a balancing of costs and benefits, and provides for and encourages public participation in the decision-making process regarding the proposed action(s). On the other hand, public participation supported by judicial decisions, based more upon procedural than substantive issues, may delay, alter, or indeed prohibit a proposed course of action. If the cognizant federal agencies (DOE and NRC in the radioactive waste area) comply with both the spirit and the letter of NEPA a framework for the successful management of radioactive wastes on all types can be developed. If however, these agencies are less than earnest in their NEPA compliance actions or if public opposition is backed by overzealous court action, any radioactive waste management/disposal action (however technically sound) can be hoisted upon a petard from which it may not be freed until well into the next century.

25322 **(DOE/OR/20722—20) Radiological survey report for the former Middlesex Sampling Plant, Middlesex, New Jersey.** (Bechtel National, Inc., Oak Ridge, TN (USA). Advanced Technology Div.). Mar 1985. Contract AC05-81OR20722. 61p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85009305.

The former Middlesex Sampling Plant (MSP), Middlesex, New Jersey is currently owned by the United States Department of Energy (DOE). It was used from 1943 to 1967 as a sampling and storage facility for uranium and thorium concentrates. During the course of operations, the buildings and grounds at the site became contaminated. In 1980, DOE initiated a multiphase remedial action project to clean up the site and several vicinity properties onto which contamination from the plant had migrated. Material from these properties was consolidated in a storage pile at the MSP during Phases I and II of the project. A decision by DOE regarding the final disposition of the site will be made once the results of an engineering evaluation of disposition alternatives and of other studies required by the National Environmental Policy Act are available. This report describes the current radiological status of the MSP site as determined by a characterization survey performed to obtain information necessary for the development of the Phase III engineering design. The grounds and the four buildings on-site were surveyed; uranium-238 and radium-226 concentrations exceeded DOE remedial action guidelines. Approximately 69,000 m^3 (91,000 yd^3) of material must be removed for the site to comply with guidelines. This total comprises the following approximate volumes: 13,000 m^3 (17,000 yd^3) of asphalt/gravel and soil from the grounds, 3650 m^3 (4775 yd^3) from demolition of the Boiler House and Process Building, and 52,000 m^3 (69,000 yd^3) of contaminated material that is or will be stored on-site. In addition, parts of the Garage and Administration Building must be decontaminated. 14 refs., 11 figs., 6 tabs.

25323 **(NUREG/CR—4237) Mobility of radionuclides in high chloride environments: a case study of waters within and near the Delaware Basin, southeastern New Mexico.** Simpson, H.J.; Herczeg, A.L.; Anderson, R.F.; Trier, R.M.; Mathieu, G.G.; Deck, B.L. (Columbia Univ., Palisades, NY (USA). Lamont-Doherty Geological Observatory). Apr 1985. 74p. NTIS, PC A04/MF A01 - GPO $4.50. File Number TI85901383.

Concentrations of naturally occurring isotopes of uranium, thorium, radium and radon were measured in freshwaters and in sodium-chloride brines near the site of the Waste Isolation Pilot Plant (WIPP) located in southeastern New Mexico. Supplemental water chemistry analyses (chloride, alkalinity, P/sub CO_3/, ΣCO_2, Fe, Mn, ΣH_2S) were made to aid in interpreting the natural radionuclide results. Three features of radionuclide mobility are evident from our results: (1) There is a slight tendency for U and Ra concentrations to correlate with the chloride content of the water samples. Whether this results from complexation by Cl^- ions or cation exchange competition for adsorption sites cannot be resolved with the available information. (2) Much more dramatic than the correlation with Cl^- concentration is the effect of the redox state of the waters on U and Ra concentrations. Chemically reducing groundwaters contain much lower U concentrations and much higher Ra concentrations than were measured in oxic and suboxic samples. Calculated retardation factors of about 1 for Ra indicate that this element can migrate freely in anoxic brines. (3) Low chemical recoveries of Th, and to a lesser extent U, by methods that work well with seawater samples suggest that these elements may be present in an unreactive dissolved or colloidal complex with organic matter. A similar situation has been observed for Pu in freshwaters containing high DOC concentrations by other investigators. The unreactive nature of the U and Th in the brines suggests that even though the concentrations are low, the U and Th that are present in the water may be quite mobile because of their unrective nature. 16 figs., 13 tabs.

25324 **(UCRL—91257) Laboratory experiments designed to provide limits on the radionuclide source term for the NNWSI Project.** Oversby, V.M.; McCright, R.D. (Lawrence Livermore National Lab., CA (USA)). Nov 1984. Contract W-7405-ENG-48. 13p. (CONF-8411160—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85009952.

From Workshop on the source term for radionuclide migration from HLW or spent nuclear fuel; Albuquerque, NM, USA (13 Nov 1984).

The Nevada Nuclear Waste Storage Investigations Project is investigating the suitability of the tuffaceous rocks at Yucca Mountain Nevada for potential use as a high-level nuclear waste repository. The horizon under investigation lies above the water table, and therefore offers a setting that differs substantially from other potential repository sites. The unsaturated zone environment allows a simple, but effective, waste package design. The source term for radionuclide release from the waste package will be based on laboratory experiments that determine the corrosion rates and mechanisms for the metal container and the dissolution rate of the waste form under expected long term conditions. This paper describes the present status of laboratory results and outlines the approach to be used in combining the data to develop a realistic source term for release of radionuclides from the waste package. 16 refs., 3 figs., 1 tab.

0540 Health And Safety

REFER ALSO TO CITATION(S) 25294, 26432

25325 **(DOE/OR/20722—27-Vol.2) Final report on Phase II remedial action at the former Middlesex Sampling Plant and associated properties. Volume 2.** (Bechtel National, Inc., Oak Ridge, TN (USA). Advanced Technology Div.). Apr 1985. Contract AC05-81OR20722. 405p. NTIS, PC A18/MF A01; 1; GPO Dep. File Number DE85009916.

Volume 2 presents the radiological measurement data taken after remedial action on properties surrounding the former Middlesex Sampling Plant during Phase II of the DOE Middlesex Remedial Action Program. Also included are analyses of the confirmatory radiological survey data for each parcel with respect to the remedial action criteria established by DOE for the Phase II cleanup and a discussion of the final status of each property. Engineering details of this project and a description of the associated health physics and environmental monitoring activities are presented in Volume 1.

25326 **(PB—85-164846/XAB) Design, build, and test an air-cleaning system for working-level control in uranium mines. Open file report October 1979-April 1984.** Schroeder, W.E.; Muldoon, T.L.; Babbitt, C. (Foster-Miller, Inc., Waltham, MA (USA)). Jun 1984. 80p. NTIS, PC A05/MF A01.

The health hazard from 222 radon byproducts, radon daughters, will be increasingly difficult to control by dilution with primary ventilation as the uranium industry digs farther and deeper for ore of diminishing grade. One solution is removal of daughters from air at the work place by filtering out respirable-size dust particles to which most daughters attach. This report describes design and testing of a filtration unit that reduces the working level in ventilating air 95% on an airflow of 10,000 cfm. Buildup of dust on the filter is controlled by periodic back-pulsing, so that the unit can operate for an extended period without changing elements. The effectiveness of the self-cleaning action was satisfactory under a contaminant loading that was 43% diesel smoke. Back-pulsing was able to control filter loading or buildup to a degree even under 100% diesel. The report describes testing of the filter medium and filter unit in both an experimental and an active mine and concludes with an analysis of the prototype design.

25327 **Calibration and field application of a Sierra Model 235 cascade impactor.** Knuth, R.H. (Dept. of Energy, New York, NY). *American Industrial Hygiene Association Journal;* 45: No. 6, 393-398(Jun 1984).

A Sierra Model 235 slotted impactor was used to measure the particle size distribution of ore dust in uranium concentrating mills. The impactor was calibrated at a flow rate of 0.21 m^3/min, using solid monodisperse particles of methylene blue and an impaction surface of Whatman #41 filter paper soaked in mineral oil. The reduction from the impactor's design flow rate of 1.13 m^3/min (40 cfm) to 0.21 m^3/min (7.5 cfm), a necessary adjustment because of the anticipated large particle sizes of ore dust, increased the stage cut-off diameters by an average factor of 2.3. Evaluation of field test results revealed that the underestimation of mass median diameters, often caused by the rebound and reentrainment of solid particles from dry impaction surfaces, was virtually eliminated by using the oiled Whatman #41 impaction surface.

0550 Regulations

25328 (DOE/ER/10275—1A, pp 1, Paper 4) **Nuclear fuel fabrication processes and safeguards.** Azarfar, M. (Oregon State Univ., Corvallis). 1982. NTIS, PC A03/MF A01. File Number DE83004080. (CONF-820359—Absts.).

From Western regional American Nuclear Society student conference; Corvallis, OR, USA (28 Mar 1982).

The standard process for preparing oxide fuel for nuclear reactors is pellet fuel fabrication. This method is currently in use for both LWR's and LMFBR's and for both UO_2 and MOX. Another method of fuel fabrication which recently has drawn some attention is the spherepac fuel fabrication process. In this method, the fuel is manufactured in the form of microspheres by a wet chemistry method. In MOX fuel fabrication, safeguards consideration is an important part of the process. A methodology was developed which compares and ranks various processes in the nuclear fuel cycle. It estimates the weights of different safeguards characteristics of a process and calculates a dimensionless number - safeguards index - for each process under evaluation. By comparing these safeguards indices, processes can be ranked against each other from the safeguards point of view. Safeguards indices were calculated for the two fabrication processes. The result revealed that the spherepac process is higher in rank relative to the pellet process; the spherepac process is simpler to safeguard relative to the pellet process.

25329 (LA—10135-C, pp 1.1-1.5) **Introduction to SSAC training course.** Hatcher, C.R. (Los Alamos National Lab., NM). Jun 1984. NTIS, PC A99/MF A01. File Number DE85004636. (CONF-8310345—).

From 4. international training course on implementation of state sysytems of accounting for the control of nuclear materials (SSAC); Santa Fe, NM, USA (17 Oct 1983).

An overview of the US DOE/IAEA three-week training course on State Systems of Accounting for and control of Nuclear Materials (SSAC) is presented. Extracurricular and administrative matters as well as course content are described.

25330 (LA—10135-C, pp 4.1-4.8) **US national material control and accounting system.** Smith, C.N. (Nuclear Regulatory Commission, Washington, DC). Jun 1984. NTIS, PC A99/MF A01. File Number DE85004636. (CONF-8310345—).

From 4. international training course on implementation of state sysytems of accounting for the control of nuclear materials (SSAC); Santa Fe, NM, USA (17 Oct 1983).

The State System of Accounting and Control (SSAC) for fuel cycle facilities in the licensed, commercial sector of the US nuclear community, and details of the material control and accounting measures dealing with the national safeguards program are discussed. The concept and role of the Fundamental Nuclear Material Control (FNMC) Plan is discussed. Also, the relationship between the national safeguards program and the international safeguards program of the US SSAC are described.

25331 (LA—10135-C, pp 5.1-5.9) **National nuclear material control and accounting system in Sweden.** Ek, P.I. (Swedish Nuclear Power Inspectorate, Stockholm). Jun 1984. NTIS, PC A99/MF A01. File Number DE85004636. (CONF-8310345—).

From 4. international training course on implementation of state sysytems of accounting for the control of nuclear materials (SSAC); Santa Fe, NM, USA (17 Oct 1983).

The Swedish SSAC and the nuclear activities to which it is related are described. Information is presented on the legal and organizational background to the SSAC as well as the objectives that guided its design, implementation, and operation. The national authority, the Swedish Nuclear Power Inspectorate, the SKI, is described with respect to organization and its relationship to the SSAC, the nuclear facilities, other authorities and the general public.

25332 (LA—10135-C, pp 8.1-8.29) **Facility safeguards at an LEU fuel fabrication facility in Japan.** Kuroi, H.; Osabe, T. (Japan Atomic Energy Research Institute, Ibaraki). Jun 1984. NTIS, PC A99/MF A01. File Number DE85004636. (CONF-8310345—).

From 4. international training course on implementation of state sysytems of accounting for the control of nuclear materials (SSAC); Santa Fe, NM, USA (17 Oct 1983).

A facility description of a Japanese LEU BWR-type fuel fabrication plant focusing on safeguards viewpoints is presented. Procedures and practices of MC and A plan, measurement program, inventory taking, and the report and record system are described. Procedures and practices of safeguards inspection are discussed and lessons learned from past experiences are reviewed.

25333 (LA—10135-C, pp 9.1-9.10) **Typical IAEA operations at a fuel fabrication plant.** Morsy, S. (International Atomic Energy Agency, Vienna, Austria). Jun 1984. NTIS, PC A99/MF A01. File Number DE85004636. (CONF-8310345—).

From 4. international training course on implementation of state sysytems of accounting for the control of nuclear materials (SSAC); Santa Fe, NM, USA (17 Oct 1983).

The IAEA operations performed at a typical Fuel Fabrication Plant are explained. To make the analysis less general the case of Low Enriched Uranium (LEU) Fuel Fabrication Plants is considered. Many of the conclusions drawn from this analysis could be extended to other types of fabrication plants. The safeguards objectives and goals at LEU Fuel Fabrication Plants are defined followed by a brief description of the fabrication process. The basic philosophy behind nuclear material stratification and the concept of Material Balance Areas (MBA's) and Key Measurement Points (KMP's) is explained. The Agency operations and verification methods used during physical inventory verifications are illustrated.

25334 (LA—10135-C, pp 10.1-10.8) **Physical protection in relation to IAEA safeguards.** Sonnier, C.S. (Sandia National Labs., Albuquerque, NM). Jun 1984. NTIS, PC A99/MF A01. File Number DE85004636. (CONF-8310345—).

From 4. international training course on implementation of state sysytems of accounting for the control of nuclear materials (SSAC); Santa Fe, NM, USA (17 Oct 1983).

The general structure of the safeguards system, the SSAC interfaces, and physical protection principles, equipment, and techniques are reviewed. In addition, the interactions between the State, the facility operator, and the IAEA are described.

25335 (LA—10135-C, pp 12.1-12.35) **Principles of near-real-time materials accounting and control systems.** Shipley, J.P. (Los Alamos National Lab., Albuquerque, NM). Jun 1984. NTIS, PC A99/MF A01. File Number DE85004636. (CONF-8310345—).

From 4. international training course on implementation of state sysytems of accounting for the control of nuclear materials (SSAC); Santa Fe, NM, USA (17 Oct 1983).

The general structural features of a national system of acountability and control and the interfaces with the IAEA safeguards system are considered. Techniques for carrying out the design of such systems, including modeling and simulation, are discussed. Measures of systems performance and methods for evaluating those measures are described. Examples of the safeguards design process for selected fuel-cycle facilities are presented.

25336 (LA—10135-C, pp 13.1-13.26) **Safeguarding nuclear power stations.** Whan, G.A. (Univ. of New Mexico, Albuquerque). Jun 1984. NTIS, PC A99/MF A01. File Number DE85004636. (CONF-8310345—).

From 4. international training course on implementation of state sysytems of accounting for the control of nuclear materials (SSAC); Santa Fe, NM, USA (17 Oct 1983).

The basic features of nuclear fuel accounting and control in present-day power reactors are considered. Emphasis is placed on reactor operations and spent-fuel characteristics for Light-Water Reactors (LWRs) and Heavy-Water Reactors (HWRs).

25337 (LA—10135-C, pp 14.1-14.36) **Elements of nondestructive assay (NDA) technology.** Hatcher, C.R.; Smith, H. (Los Alamos National Lab., Albuquerque, NM). Jun 1984. NTIS, PC A99/MF A01. File Number DE85004636. (CONF-8310345—).

From 4. international training course on implementation of state sysytems of accounting for the control of nuclear materials (SSAC); Santa Fe, NM, USA (17 Oct 1983).

A thorough introduction to nondestructive assay methods and instruments as they are applied to nuclear safeguards is presented. The general principles and major applications of NDA are discussed and situations in which NDA is particularly useful for nuclear safeguards purposes are described. Various passive and active γ-ray and neutron methods are examined and assay situations particularly suited to γ-ray techniques, or to neutron techniques are identified. The role of calorimetry in the NDA of plutonium-bearing materials is also discussed. The advantages and disadvantages of various NDA methods for different types of nuclear materials are mentioned.

25338 (LA—10135-C, pp 15.1-15.11) **NDA measurements for LEU fuel fabrication facilities.** Augustson, R.H. (Los Alamos National Lab., Albuquerque, NM). Jun 1984. NTIS, PC A99/MF A01. File Number DE85004636. (CONF-8310345—).

From 4. international training course on implementation of state sysytems of accounting for the control of nuclear materials (SSAC); Santa Fe, NM, USA (17 Oct 1983).

The principal NDA techniques used for measurement of low-enriched uranium (LEU) and how these techniques can be applied to different material balance areas in an LEU fuel fabrication plant are described.

25339 (LA—10135-C, pp 16.1-16.33) **Tour of Los Alamos Safeguards R and D laboratories: demonstration and use of NDA instruments and material control and accounting simulation.** Jun 1984. NTIS, PC A99/MF A01. File Number DE85004636. (CONF-8310345—).

From 4. international training course on implementation of state sysytems of accounting for the control of nuclear materials (SSAC); Santa Fe, NM, USA (17 Oct 1983).

A description is presented of the nondestructive assay techniques and instrumentation for measuring the fissile content of fuel assemblies and fuel components. The course participants had a hands-on tour of this instrumentation and material accounting and control systems at Los Alamos National Laboratory.

25340 (LA—10135-C, pp 17a.1-17a.11) **Basis of plant accounting system.** Schneider, R.A. Jun 1984. NTIS, PC A99/MF A01. File Number DE85004636. (CONF-8310345—).

From 4. international training course on implementation of state sysytems of accounting for the control of nuclear materials (SSAC); Santa Fe, NM, USA (17 Oct 1983).

This presentation describes in an introductory manner the accountability design approach which is used for the Model Plant in order to meet US safeguards requirements. The general requirements for the US national system are first presented. Next, the approach taken to meet each general requirement is described. This presentation introduces the general concepts and principles of the accountability system.

25341 (LA—10135-C, pp 17b.1-17b.8) **Model plant accounting system.** Schnaible, M.F. Jun 1984. NTIS, PC A99/MF A01. File Number DE85004636. (CONF-8310345—).

From 4. international training course on implementation of state sysytems of accounting for the control of nuclear materials (SSAC); Santa Fe, NM, USA (17 Oct 1983).

This presentation describes some basic concepts and techniques used in the model plant accounting system and relates them to US safeguards requirements.

25342 (LA—10135-C, pp 18a.1) **Brief plant description.** McAlees, D.G. Jun 1984. NTIS, PC A99/MF A01. File Number DE85004636. (CONF-8310345—).

From 4. international training course on implementation of state sysytems of accounting for the control of nuclear materials (SSAC); Santa Fe, NM, USA (17 Oct 1983).

The fuel fabrication plant layout is described in relation to the measurement points, material flow, and main process steps.

25343 (LA—10135-C, pp 18b.1-18b.5) **Model plant Key Measurement Points.** Schneider, R.A. Jun 1984. NTIS, PC A99/MF A01. File Number DE85004636. (CONF-8310345—).

From 4. international training course on implementation of state sysytems of accounting for the control of nuclear materials (SSAC); Santa Fe, NM, USA (17 Oct 1983).

For IAEA safeguards a Key Measurement Point is defined as the location where nuclear material appears in such a form that it may be measured to determine material flow or inventory. This presentation describes in an introductory manner the key measurement points and associated measurements for the model plant used in this training course.

25344 (LA—10135-C, pp 21.1-21.6) **Nuclear inventory control system.** Kraft, A. Jun 1984. NTIS, PC A99/MF A01. File Number DE85004636. (CONF-8310345—).

From 4. international training course on implementation of state sysytems of accounting for the control of nuclear materials (SSAC); Santa Fe, NM, USA (17 Oct 1983).

This presentation describes the design used in accounting for nuclear material in the Model Plant. Many of the design philosophies are in response to the Nuclear Regulatory Commission regulations.

25345 (LA—10135-C, pp 23.1-23.12) **Assignment of element and isotope factors.** Schneider, R.A. Jun 1984. NTIS, PC A99/MF A01. File Number DE85004636. (CONF-8310345—).

From 4. international training course on implementation of state sysytems of accounting for the control of nuclear materials (SSAC); Santa Fe, NM, USA (17 Oct 1983).

Element and isotope factors are assigned in the NICS internal accounting system at the Exxon Fuel Fabrication Facility on the basis of coded information included on the material transfer documents. This paper explains more fully the manner in which NICS assigns these factors.

25346 (LA—10135-C, pp 24.1-24.20) **Procedure for taking physical inventories.** Boston, R.A. Jun 1984. NTIS, PC A99/MF A01. File Number DE85004636. (CONF-8310345—).

From 4. international training course on implementation of state sysytems of accounting for the control of nuclear materials (SSAC); Santa Fe, NM, USA (17 Oct 1983).

Physical inventories are taken periodically to meet Company, State and IAEA requirements. Those physical inventories may be verified by IAEA and/or State inspectors. This presentation describes in an introductory but detailed manner the approaches and procedures used in planning, preparing, conducting, reconciling and reporting physical inventories for the Model Plant. Physical inventories are taken for plant accounting purposes to provide an accurate basis for starting and closing the plant material balance. Physical inventories are also taken for safeguards purposes to provide positive assurance that the nuclear materials of concern are indeed present and accounted for.

25347 (LA—10135-C, pp 25.1-25.7) **Use of tamper-indicating seals at model facility. Part 1.** Logsdon, R.B. Jun 1984. NTIS, PC A99/MF A01. File Number DE85004636. (CONF-8310345—).

From 4. international training course on implementation of state sysytems of accounting for the control of nuclear materials (SSAC); Santa Fe, NM, USA (17 Oct 1983).

Tamper-indicating seals, when applied to containers of nuclear material, serve a vital safeguards function. Because of the importance of the seal in safeguards, it is essential that their acquisition, storage, and distribution be controlled effectively. These functions are described for the model facility.

25348 (LA—10135-C, pp 26.1-26.27) **Analytical methods used at model facility.** Wing, N.S. Jun 1984. NTIS, PC A99/MF A01. File Number DE85004636. (CONF-8310345—).

From 4. international training course on implementation of state sysytems of accounting for the control of nuclear materials (SSAC); Santa Fe, NM, USA (17 Oct 1983).

A description of analytical methods used at the model LEU Fuel Fabrication Facility is presented. The methods include gravimetric uranium analysis, isotopic analysis, fluorimetric analysis, and emission spectroscopy.

25349 (LA—10135-C, pp 27.1-21.10) **NDA methods used at model facility.** Johnson, K.O. Jun 1984. NTIS, PC A99/MF A01. File Number DE85004636. (CONF-8310345—).

From 4. international training course on implementation of state sysytems of accounting for the control of nuclear materials (SSAC); Santa Fe, NM, USA (17 Oct 1983).

The NDA methods for the waste assay system, the powder assay system, and the rod assay system at the model facility are described. The NaI scintillation detectors used in the assay systems are also discussed.

25350 (LA—10135-C, pp 28.1-28.15) **Measurement control program at model facility.** Schneider, R.A. Jun 1984. NTIS, PC A99/MF A01. File Number DE85004636. (CONF-8310345—).

From 4. international training course on implementation of state sysytems of accounting for the control of nuclear materials (SSAC); Santa Fe, NM, USA (17 Oct 1983).

A measurement control program for the model plant is described. The discussion includes the technical basis for such a program, the application of measurement control principles to each measurement, and the use of special experiments to estimate measurement error parameters for difficult-to-measure materials. The discussion also describes the statistical aspects of the program, and the documentation procedures used to record, maintain, and process the basic data.

25351 (LA—10135-C, pp 29a.1-29a.13) **Tour of safeguards equipment van.** Smith, B.W.; Fager, J.E. (Pacific Northwest Lab., Richland, WA). Jun 1984. NTIS, PC A99/MF A01. File Number DE85004636. (CONF-8310345—).

From 4. international training course on implementation of state sysytems of accounting for the control of nuclear materials (SSAC); Santa Fe, NM, USA (17 Oct 1983).

Increasing use is being made of nondestructive assay instruments for identification and measurements of nuclear materials. Important advantages of NDA are: timeliness, portability, and ease of use. Recent development in computer systems and NDA allow for the integration of sample planning, control of NDA, and data analysis into one transportable system. This session acquainted the course participants with the use of mobile NDA safeguards measurement systems. This session considered the practical problems and the type of results that can be expected from field use of NDA instruments. An existing mobile safeguards system was used to demonstrate some of the differences between field and laboratory conditions.

25352 (LA—10135-C, pp 30.1-30.4) **Calculating uncertainties of safeguards indices: error propagation.** Jaech, J.L. Jun 1984. NTIS, PC A99/MF A01. File Number DE85004636. (CONF-8310345—).

From 4. international training course on implementation of state sysytems of accounting for the control of nuclear materials (SSAC); Santa Fe, NM, USA (17 Oct 1983).

Statistical methods play an important role in making references about a MUF, shipper-receiver difference, operator-inspector difference, and other safeguards indices. This session considers the sources and types of measurement errors and treats a specific exam-

ple to illustrate how the variance of MUF is calculated for the model plant.

25353 (LA—10135-C, pp 31.1-31.3) **Calculating the variance of the difference statistic.** Jaech, J.L. Jun 1984. NTIS, PC A99/MF A01. File Number DE85004636. (CONF-8310345—).

From 4. international training course on implementation of state sysytems of accounting for the control of nuclear materials (SSAC); Santa Fe, NM, USA (17 Oct 1983).

Calculation of the variance of the difference statistic, which arises in inspection situations and in shipper-receiver difference analyses, is discussed.

25354 (LA—10135-C, pp 32.1-32.3) **Estimation of measurement variances.** Jaech, J.L. Jun 1984. NTIS, PC A99/MF A01. File Number DE85004636. (CONF-8310345—).

From 4. international training course on implementation of state sysytems of accounting for the control of nuclear materials (SSAC); Santa Fe, NM, USA (17 Oct 1983).

The estimation of measurement error parameters in safeguards systems is discussed. Both systematic and random errors are considered. A simple analysis of variances to characterize the measurement error structure with biases varying over time is presented.

25355 (LA—10135-C, pp 34.1-34.5) **Statistical sampling plans.** Jaech, J.L. Jun 1984. NTIS, PC A99/MF A01. File Number DE85004636. (CONF-8310345—).

From 4. international training course on implementation of state sysytems of accounting for the control of nuclear materials (SSAC); Santa Fe, NM, USA (17 Oct 1983).

In auditing and in inspection, one selects a number of items by some set of procedures and performs measurements which are compared with the operator's values. This session considers the problem of how to select the samples to be measured, and what kinds of measurements to make. In the inspection situation, the ultimate aim is to independently verify the operator's material balance. The effectiveness of the sample plan in achieving this objective is briefly considered. The discussion focuses on the model plant.

25356 (LA—10135-C, pp 35.1-35.10) **Typical NRC inspection procedures for model plant.** Blaylock, J. (Nuclear Regulatory Commission, Washington, DC). Jun 1984. NTIS, PC A99/MF A01. File Number DE85004636. (CONF-8310345—).

From 4. international training course on implementation of state sysytems of accounting for the control of nuclear materials (SSAC); Santa Fe, NM, USA (17 Oct 1983).

A summary of NRC inspection procedures for a model LEU fuel fabrication plant is presented. Procedures and methods for combining inventory data, seals, measurement techniques, and statistical analysis are emphasized.

25357 (LA—10135-C, pp 36.1-36.25) **Typical IAEA inspection procedures for model plant.** Theis, W. (International Atomic Energy Agency, Vienna, Austria). Jun 1984. NTIS, PC A99/MF A01. File Number DE85004636. (CONF-8310345—).

From 4. international training course on implementation of state sysytems of accounting for the control of nuclear materials (SSAC); Santa Fe, NM, USA (17 Oct 1983).

This session briefly refers to the legal basis for IAEA inspections and to their objectives. It describes in detail the planning and performance of IAEA inspections, including the examination of records, the comparison of facility records with State reports, flow and inventory verifications, the design of statistical sampling plans, and Agency's independent verification measurements. In addition, the session addresses the principles of Material Balance and MUF evaluation, as well as the content and format of summary statements and related problems.

25358 (LA—10135-C, pp 37a.1-37a.28) **Description of reference (model) plant.** Schneider, R.A. Jun 1984. NTIS, PC A99/MF A01. File Number DE85004636. (CONF-8310345—).

From 4. international training course on implementation of state sysytems of accounting for the control of nuclear materials (SSAC); Santa Fe, NM, USA (17 Oct 1983).

For the workshop on Safeguards System design for a fuel fabrication plant, a generic example of a LEU bulk-handling facility that is based on the Exxon LWR fuel fabrication plants is used. The model plant information is given in the following separate sections: (1) process assumptions; (2) six-month material balance model; (3) measurements; (4) error parameters, measurements, and σ MUF calculations; (5) material control areas; (6) accounting, records, and reports; (7) tamper-safing; and (8) measurement control program.

25359 (LA—10135-C, pp 37b.1-37b.21) **Preparation of a Fundamental Nuclear Material Control Plan.** Schneider, R.A. Jun 1984. NTIS, PC A99/MF A01. File Number DE85004636. (CONF-8310345—).

From 4. international training course on implementation of state sysytems of accounting for the control of nuclear materials (SSAC); Santa Fe, NM, USA (17 Oct 1983).

The preparation of a Fundamental Nuclear Material Control Plan (FNMC) for a model fuel fabrication plant is described. The FNMC is a formal safeguards document required by US regulations.

25360 (LA—10135-C, pp 37c.1-37c.67) **Preparation of Design Information Questionnaire (DIQ) for model fuel fabrication plant.** Schneider, R.A. Jun 1984. NTIS, PC A99/MF A01. File Number DE85004636. (CONF-8310345—).

From 4. international training course on implementation of state sysytems of accounting for the control of nuclear materials (SSAC); Santa Fe, NM, USA (17 Oct 1983).

The preparation of a Design Information Questionnaire (DIQ) for a model fuel fabrication plant is described. The DIQ is a formal safeguards document for submission to the IAEA.

25361 (LA—10135-C, pp 38.1-38.29) **MC and A system design workshop.** Schneider, R.A.; Harms, N.L. Jun 1984. NTIS, PC A99/MF A01. File Number DE85004636. (CONF-8310345—).

From 4. international training course on implementation of state sysytems of accounting for the control of nuclear materials (SSAC); Santa Fe, NM, USA (17 Oct 1983).

The workshop had as its goal the development of a Material Control and Accounting (MC and A) system for a low enriched uranium fuel fabrication plant. The factors to be considered for each of the ten key elements of the safeguards (MC and A) are presented in the text for the session.

25362 (LA—10135-C, pp 39.1-39.7) **Reports of MC and A system design workshop subgroups.** Hatcher, C.R. Jun 1984. NTIS, PC A99/MF A01. File Number DE85004636. (CONF-8310345—).

From 4. international training course on implementation of state sysytems of accounting for the control of nuclear materials (SSAC); Santa Fe, NM, USA (17 Oct 1983).

A summary of subgroup reports from the workshop on design of a materials control and accounting system for a low-enrichment fuel fabrication facility is presented. Responses to a MC and A design system questionnaire are also summarized.

25363 (LA—10135-C, pp 2.1-2.10) **Development and current trends in the international nonproliferation regime.** Sessoms, A.L. (Dept. of State, Washington, DC). Jun 1984. NTIS, PC A99/MF A01. File Number DE85004636. (CONF-8310345—).

From 4. international training course on implementation of state sysytems of accounting for the control of nuclear materials (SSAC); Santa Fe, NM, USA (17 Oct 1983).

The IAEA and its safeguards system is placed into a historical perspective. A personal perspective on the nonproliferation regime and on the Agency's role in it is then presented. This is done initially by discussing some of the landmark events in the history of the nonproliferation regime. Subsequently some of the history of arms control agreements and of the role of the IAEA are noted. Then political motivations of state and ways the Agency has an impact in the political nonproliferation sphere are addressed.

25364 (LA—10135-C, pp 3.1-3.14) **Overview of IAEA guidelines for state systems of accounting for and control of nuclear materials: objectives, diversion of nuclear material, and the IAEA safeguards system.** Buechler, C. (International Atomic Energy Agency, Vienna, Austria). Jun 1984. NTIS, PC A99/MF A01. File Number DE85004636. (CONF-8310345—).

From 4. international training course on implementation of state sysytems of accounting for the control of nuclear materials (SSAC); Santa Fe, NM, USA (17 Oct 1983).

Topics discussed include IAEA safeguards statutes, project and transfer agreements, agreements pursuant to the Non-Proliferation Treaty, implementation of IAEA safeguards, diversion strategies, accountancy and surveillance systems, and verification.

25365 (LA—10135-C, pp 11.1-11.24) **IAEA safeguards information system.** Nardi, J. (International Atomic Energy Agency, Vienna, Austria). Jun 1984. NTIS, PC A99/MF A01. File Number DE85004636. (CONF-8310345—).

From 4. international training course on implementation of state sysytems of accounting for the control of nuclear materials (SSAC); Santa Fe, NM, USA (17 Oct 1983).

The basic concepts, structure, and operation of the Agency Safeguards Information System is discussed with respect to its role in accomplishing the overall objectives of safeguards. The basis and purposes of the Agency's information system, the structure and flow of information within the Agency's system, the relationship of the components is the Agency system, the requirements of Member States in respect of their reporting to the Agency, and the relationship of accounting data vis-a-vis facility and inspection data are described.

25366 **(REG/G—3.55) Standard format and content for the Health and Safety Sections of license renewal applications for uranium hexafluoride production.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research). Apr 1985. 36p. NTIS, PC A03/MF A01 - GPO. File Number TI85901370.

Section 40.43, "Renewal of Licenses," of 10 CFR Part 40, "Domestic Licensing of Source Material," specifies that applications for renewal of specific licenses, including those for production of uranium hexafluoride, should be filed in accordance with Section 40.31, "Applications for Specific Licenses." Section 40.31 identifies the general information required. This "Standard Format and Content for the Health and Safety Sections of License Renewal Applications for Uranium Hexafluoride Production" was prepared to provide more specific guidance for the preparation of the health and safety sections of renewal applications. The Environment Report is submitted separately.

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

0701 Physical Isotope Separation

25367 **Method of producing ^{67}Cu.** O'Brien, H.A.; Barnes, J.W.; Bentley, G.E.; Taylor, W.A.; Thomas, K.E. (to Dept. of Energy). US Patent 4,487,738. 11 Dec 1984. Filed date 21 Mar 1983. vp.

PAT-APPL-477459.

A method of producing carrier-free ^{67}Cu by proton spallation combined with subsequent chemical separation and purification is disclosed. A target consisting essentially of pressed zinc oxide is irradiated with a high energy, high current proton beam to produce a variety of spallogenic nuclides, including ^{67}Cu and other copper isotopes. The irradiated target is dissolved in a concentrated acid solution to which a palladium salt is added. In accordance with the preferred method, the spallogenic copper is twice coprecipitated with palladium, once with metallic zinc as the precipitating agent and once with hydrogen sulfide as the precipitating agent. The palladium/copper precipitate is then dissolved in an acid solution and the copper is separated from the palladium by liquid chromatography on an anion exchange resin.

0702 Radiation Sources

REFER ALSO TO CITATION(S) 25978

25368 **(DOE/CH/10211—2) Use of gamma radiation as a form of preservation of sweet potatoes. Quarterly progress report, October 1, 1984-December 31, 1984.** (Tuskegee Inst., AL (USA). Carver Research Foundation). 30 Apr 1985. Contract FG02-84CH10211. 36p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85010378.

One of the radiation doses was changed from a planned level to 80 krads due to difficulties during irradiation at Georgia Tech. Equipment and supplies are still arriving slowly but we have found ways around most delays. We have also required more supplies than we originally anticipated. The data are and will be so extensive that we have asked for an extension of two months in order to have more time to sufficiently analyze it.

25369 **(PNL—5373) Cherry Irradiation Studies. 1984 annual report.** Eakin, D.E.; Hungate, F.P.; Tingey, G.L.; Olsen, K.L.; Fountain, J.B.; Burditt, A.K. Jr.; Moffit, H.R.; Johnson, D.A.; Lunden, J.D. (Pacific Northwest Labs., Richland, WA (USA)). Apr 1985. Contract AC06-76RL01830. 22p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010825.

Fresh cherries, cherry fruit fly larvae, and codling moth larvae were irradiated using the PNL cobalt-60 facility to determine the efficacy of irradiation treatment for insect disinfestation and potential shelf life extension. Irradiation is an effective disinfestation treatment with no significant degradation of fruit at doses well above those required for quarantine treatment. Sufficient codling moth control was achieved at projected doses of less than 25 krad; cherry fruit fly control, at projected doses of less than 15 krad. Dose levels up to 60 krad did not adversely affect cherry quality factors tested. Irradiation above 60 krad reduced the firmness of cherries but had no significant impact on other quality factors tested. Irradiation of cherries below 80 krad did not result in any significant differences in sensory evaluations (appearance, flavor, and firmness) in tests conducted at OSU. Irradiation up to 200 krad at a temperature of about 25°C (77°F) did not measurably extend shelf life. Irradiation at 500 krad at 25°C (77°F) increased mold and rotting of cherries tested. There is no apparent advantage of irradiation over low-temperature fumigation.

25370 **(PNL—5380) Potential value of Cs-137 capsules.** Bloomster, C.H.; Brown, D.R.; Bruno, G.A.; Hazelton, R.F.; Hendrickson, P.L.; Lezberg, A.J.; Tingey, G.L.; Wilfert, G.L. (Pacific Northwest Labs., Richland, WA (USA)). Apr 1985. Contract AC06-76RL01830. 175p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85010540.

We determined the value of Cs-137 compared to Co-60 as a source for the irradiation of fruit (apples and cherries), pork and medical supplies. Cs-137, in the WESF capsule form, had a value of approximately $0.40/Ci as a substitute for Co-60 priced at approximately $1.00/Ci. The comparison was based on the available curies emitted from the surface of each capsule. We developed preliminary designs for fourteen irradiation facilities; seven were based on Co-60 and seven were based on Cs-137. These designs provided the basis for estimating capital and operating costs which, in turn, provided the basis for determining the value of Cs-137 relative to Co-60 in these applications. We evaluated the effect of the size of the irradiation facility on the value of Cs-137. The cost of irradiation is low compared to the value of the product. Irradiation of apples for disinfestation costs $.01 to .02 per pound. Irradiation for trichina-safe pork costs $.02 per pound. Irradiation of medical supplies for sterilization costs $.07 to .12 per pound. The cost of the irradiation source, either Co-60 or Cs-137, contributed only a minor amount to the total cost of irradiation, about 5% for the fruit and hog cases and about 20% for the medical supply cases. We analyzed the sensitivity of the irradiation costs and Cs-137 value to several key assumptions.

0703 Isotopic Power Supplies

25371 (PNL—5328) Radioluminescent lighting for Alaskan runway lighting and marking. Jensen, G.A.; Leonard, L.E. (Pacific Northwest Labs., Richland, WA (USA)). Mar 1985. Contract AC06-76RL01830. 52p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85010405.

Alaska and other far northern areas have special logistical, environmental, and economic problems that make radioluminescent (RL) lighting applications, especially in the area of airport lighting, an attractive alternative to electrical systems and flare pots. Tests and demonstrations of prototype systems conducted in Alaska over the past two years have proved the basic technological worth of RL airport lighting systems for civilian and military use. If regulatory issues and other factors identified during these tests can be favorably resolved and if the system and its components can be refined through production engineering, attractive applications for RL airfield lighting systems in Alaska and other remote locations could result.

08 HYDROGEN

0801 Production

REFER ALSO TO CITATION(S) 25411

25372 (EUR—9112-EN) Immobilization of hydrogenase systems for the photochemical, photovoltaical and photobiological production of hydrogen. Veeger, C.; Grande, H.J.; Laane, C.; Leeuwen, J.W. van; Dijk, C. van; Berkel-Arts, A. van; Kruese-Wolters, M. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1984. 98p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

The system investigated made use of the properties of the enzyme hydrogenase in its reaction with a reduced electron donor (artificial or natural) to produce hydrogen. The hydrogenases were the purified enzymes from Desulfovibrio vulgaris or Megasphaera elsdenii. The kinetic properties of both hydrogenases were studied with respect to their dependence of pH and redox potential and a kinetic mechanism was proposed. In order to obtain insight in reaction of the hydrogenases with their natural electron donor the redox properties of cytochrome c_3 (D. vulgaris) and flavodoxin (M. elsdenii) were studied by their rates of reaction with the artificial electron donor the methyl viologen radical. The possibilities of technological application of hydrogenases in the production of hydrogen seem to be increased by the finding that it is possible to convert the enzyme from D. vulgaris from the oxygen-sensitive form under working conditions into an oxygen-stable form. The hydrogenase from M. elsdenii cannot be converted. The efficiency of electron transfer from the mercury and glassy-carbon electrodes to electron-transferring proteins was studied. Optimum electron transfer conditions were achieved.

25373 (EUR—9275-EN) Biophotolysis of water for hydrogen production via natural and artificial catalytic systems. Rao, K.K.; Hall, D.O. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1984. 40p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

Investigations on the stabilization of the chloroplasts used in biophotolytic systems were carried out by measuring the activity of various segments of the photosynthetic electron transport chain of chloroplasts during the H_2 evolution. Chloroplasts were immobilized in agar, calcium alginate and polyurethane films with retention of varying degrees of photosynthetic electron transport - immobilized chloroplasts were generally more stable than free chloroplasts. The efficiency of various natural and synthetic molecules to transfer electrons from water to hydrogenase through the thylakoid membrane electron transport chain was measured. The oxygen stability of Clostridium pasteurianum and Desulfovibrio desulfuricans hydrogenases were improved by immobilization on to activated silica derivatives. Cyanobacterial cells immobilized on polyurethane foams maintained their PSI activity in continuous light for more than two weeks - they were able to photoreduce methylviologen using ascorbate as electron donor. Hydrogenases were immobilized on to semiconductor particles (TiO_2 and CdS); irradiation in the presence of a sacrificial electron donor and an electron mediator resulted in continuous photoproduction of H_2. The light conversion efficiency of some of the photo H_2 evolving system was determined.

25374 (MRI/SOL—1101, pp 345-358) Aqueous electrolytic hydrogen production. Kincaide, W.C. (Teledyne Energy Systems, Timonium, MD). 1982. NTIS, PC A19/MF A01. File Number DE84015232. (CONF-820312—; SERI/CP—270-1521).

From Solar storage workshop; Jeddah, Saudi Arabia (21 Mar 1982).

Hydrogen and the synthetic chemicals that can be made with hydrogen, such as methanol and ammonia, will play an important role in future energy scenarios, particularly in the transportation, storage, and distribution of energy from renewable resources. The only problem with this prediction is that no one can say for certain how or when it will happen. Water electrolysis is the most efficient and practical means for converting renewable energy to hydrogen; however, electrolytic hydrogen is not generally able to compete in today's market with hydrogen made from natural gas except under special circumstances. This paper reviews the various electrolysis technologies that have been developed over the years and discusses future systems in terms of both efficiency and size, particularly as they relate to work at Teledyne Energy Systems.

25375 (NP—5770278) Hydrogen production using Rhodospirillum. Reh, U. (Freie Univ. Berlin (Germany, F.R.). Fachbereich Biologie). 14 Nov 1983. 159p. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number DE85770278.

The rates of degradation of organic substances from a synthetic medium and from whey, factory molasse and potato water obtained as food by-products into hydrogen and CO_2 by means of the rhodospirillaceae Rp. capsulata, Rp. acidophila, Rm. vanielii, Rs. rubrum and Rs. tenue were investigated. Rs. rubrum was found to be superior to all other rhodospirillaceae in hydrogen production, releasing up to 86% of the substrate hydrogen from the synthetic lactate broth, 56% from whey, 46% from beet sugar molasse, 89% from cane sugar molasse, and 19% from potato water.

25376 (PB—85-159028/XAB) Stabilization of biological photosystems: continuous reactor use for hydrogen production through biophotolysis of water, 1984. Cocquempot, M.F.; Larreta Garde, V.; Lissolo, T.; Pulvin, S.; Thomasset, B. (Commission of the European Communities, Luxembourg). 1984. 60p. (EUR—9111-EN). NTIS, PC E04/MF E01.

See also PB82-146820. Prepared in cooperation with Laboratoire de Technologie Enzymatique, Compiegne (France).

The key point and limiting step for the use of photosynthetic systems in direct bioconversion of solar energy is the low stability of their functions. Immobilization can be a tool for increasing the longevity of biocatalysts and allow their use in bioconversion processes such as photoproduction of hydrogen gas from water using solar energy. Chloroplast membranes have been immobilized within various supports. A detailed study of these immobilized chloroplast membranes has been done. The use of continuous flow reactors allowed to study the real functional stability of photosynthetic systems. The efficiency of combined systems (chloroplast membranes-hydrogenase) has been tested. Co-immobilization of biocatalysts improves considerably the H2 photoproduction. The economic feasibility of combined systems to produce hydrogen has constrained us to use an hydrogenase exhibiting no inhibition in presence of molecular oxygen. The stabilization of a bacterial photosynthetic activity was also studied and photoreactors were built in order to produce a high added value molecule through a light-energy dependent process.

25377 **Aqueous catalyst systems for the water-gas shift reaction. Part 1. Comparative catalyst studies.** Elliott, D.C.; Sealock, L.J. Jr. (Battelle Pacific Northwest Lab., Richland, WA). *Industrial and Engineering Chemistry, Product Research and Development;* 22: 426-431(Sep 1983).

A comparative study of both aqueous and nonaqueous catalysts - metal carbonates, alkali metal salts, and supported metal oxides - for the water-gas shift reacton utilized a pressurized aqueous batch reactor system. Test results showed that (1) alkali metal salts catalyze the water-gas shift reaction in the temperature range of 390°-750°F, (2) alkali metal salts and some transition metal salts are significantly more active than similar alkali earth compounds, (3) several alkali compounds can act as catalysts (or generate a catalytic species in situ) for the water-gas shift reaction in a pressurized aqueous system, (4) the cation need not be a metal, and (5) aqueous solutions of sodium carbonate may display activity levels similar to or higher than those of supported metal oxides in a pressurized system.

25378 **Aqueous catalyst systems for the water-gas shift reaction. Part 2. Mechanism of basic catalysis.** Elliott, D.C.; Hallen, R.T.; Sealock, L.J. Jr. (Batelle Pacific Northwest Lab., Richland, WA). *Industrial and Engineering Chemistry, Product Research and Development;* 22: 431-435(Sep 1983).

A proposed mechanism for the catalysis of the water-gas shift reaction by basic aqueous solutions in a pressurized reactor is a cyclic system with three intermediate anions: carbonate, hydroxide, and formate. A carbonate ion reacts with water to form hydroxide and carbon dioxide; the hydroxide ion reacts with carbon monoxide to generate formate that decomposes to carbonate and formaldehyde and, in turn, hydrogen. The mechanism can proceed in the presence of any basic catalyst precursor that generates one of the three catalytic species.

25379 **Hydrogen and oxygen photoproduction by marine algae.** Greenbaum, E.; Guillard, R.R.L.; Sunda, W.G. (Oak Ridge National Lab., TN). *Photochemistry and Photobiology;* 37: No. 6, 649-655(1983). Contract W-7405-ENG-26.

The first measurements of the simultaneous photoproduction of hydrogen and oxygen in marine green algae are reported. Eight species in the genera Chlamydomonas, Chlorella and Halochlorococcum were tested in CO_2-free seawater. Four of the five species of Chlamydomonas were able to produce hydrogen in the light after a period of 3-4 h of dark anaerobic adaptation. Only one of the two Chlorella species tested was able to photoproduce hydrogen, in trace amounts. Halochlorococcum fla-9 gave positive results and Chlamydomonas species (clone f-9) had a steady-state rate of hydrogen and oxygen production during irradiation with a stoichiometric ratio near 2:1. The integrated yields of hydrogen and oxygen produced by this species corresponds to about 450 turnovers of the photochemical reaction centers. This number exceeds (by about a factor of 20) the electron-carrying capacity of the electron transport chain linking Photosystems I and II. These data suggest that Chlamydomonas f-9 makes seawater a potential substrate for solar hydrogen and oxygen production. 20 references, 2 figures, 1 table.

0802 Storage

25380 (MRI/SOL—1101, pp 317-344) **Hydrogen storage, transport and use.** Bockris, J.O'M.; Gutmann, F.; Murphy, O.J. (Texas A and M Univ., College Station). 1982. NTIS, PC A19/MF A01. File Number DE84015232. (CONF-820312—; SERI/CP—270-1521).

From Solar storage workshop; Jeddah, Saudi Arabia (21 Mar 1982).

Bulk and cryogenic hydrogen storage in metal hydrides, in cryoadsorbants, in microcavities, in zeolites, in liquid organic hydrides, in metal aromatics and in metal or graphite complexes, and via conversion into ammonia or methanol is critically discussed. A novel method of magneto-refrigeration, developed by J.A. Barclay at the Los Alamos National Laboratory, is reviewed. Hydrogen transport, via pipelines and by other means, is discussed. Some of the feasible uses of hydrogen as a fuel are reviewed, especially in internal combustion engines, such as railroad locomotives, buses, and automobiles, or in airplanes and homes.

0804 Marketing And Economics

25381 **Economics of hydrogen production: the next twenty-five years.** Gaines, L.L.; Wolsky, A.M. (Argonne National Lab., IL). *Hydrogen Energy Progress;* 5: 259-270([1985]).

The costs of hydrogen produced through 2010 in the US using four commercially available technologies (electrolysis and three fossil-fuel processes) are projected. The projections are based on estimated capital costs and real energy prices projected by five sources. The sensitivity of hydrogen cost to changes in feedstock costs and the fixed charge rate on capital is examined. The cost is stable against variation in feedstock prices because feedstocks can be changed. The timing of any such change would depend on the capital charge rate. The results establish cost goals for new technologies attempting to penetrate the market for chemical hydrogen; they also indicate the economic competitiveness of conventionally produced hydrogen in the fuel market. In 2010, hydrogen delivered to customers will be more expensive than methane, its strongest competitor, and any transition to a hydrogen economy in the US will not yet have begun. In nations with higher oil and gas costs or lower electricity costs, such a transition could occur earlier.

0806 Industrial And Commercial Use

REFER ALSO TO CITATION(S) 25380

09 OTHER SYNTHETIC AND NATURAL FUELS

REFER ALSO TO CITATION(S) 25717

0901 Hydrocarbon Fuels

REFER ALSO TO CITATION(S) 25512

25382 **(CONF-850655—1) Thermal gasification of biomass: the IGT RENUGAS process.** Babu, S.P.; Onischak, M.; Bair, W.G. (Institute of Gas Technology, Chicago, IL (USA)). 1985. 24p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005069.

From 16. world gas conference; Munich, F.R. Germany (24 Jun 1985).

The Institute of Gas Technology's RENUGAS process is being developed for thermal gasification of biomass to produce medium-calorific value and synthesis gas, with primary support from the US Department of Energy. The process employs a single-stage pressurized, oxygen-blown, fluidized-bed gasifier. Substituting air for oxygen produces a lower calorific value gas suitable for either combined-cycle power generation or direct combustion. The process development unit constructed to develop this process consists of a 29.2 cm ID gasifier, capable of gasifying biomass under adiabatic conditions, at pressures up to 3.55 MPa, at temperatures up to 1255 K, and at biomass feed rates up to 10,150 kg/m³-h. Tests conducted with feed rates up to 340 kg/h have shown that pressurized gasification PDU at 2.17 MPa and 1028 to 1172 K, of woody biomass is simple. Analysis of temperature variation test results show that total carbon conversion exceeds 92%, above 1090 K and it could be increased further by recycling the entrained char to the high temperature region of the gasifier. The oxygen requirement at 1090 K is about 0.22 kg/kg of (10% moisture) feed material. Pressurized gasification produces nearly two-thirds of potential methane within the gasifier. The dry gas yield ranged from 0.88 m³/kg feed to 1.18 m³/kg feed and the gross calorific value of the fuel gas ranges from about 13.3 MJ/m³ (st) to 10.9 MJ/m³ (st) at 1028 and 1245 K, respectively. This medium calorific value gas could be either used on-site or distributed in pipelines for short distances for use as an industrial fuel gas. Based on the measured data the cold gas thermal efficiency varies from 74 to 76% for tests conducted at 1090 K to 1256 K.

25383 (DOE/PC/40077—T8) Liquid hydrocarbon fuels from syngas. Thirteenth quarterly progress report, March-May 1984. Rabo, J.A. (Union Carbide Corp., Tarrytown, NY (USA). Tarrytown Technical Center). Jan 1985. Contract AC22-81PC40077. 274p. NTIS, PC A12/MF A01; 1; GPO Dep. File Number DE85009613.

Of the twelve catalysts tested in this quarter, none showed any significant effectiveness. The principal value of the quarter's work has been in whatever guidance may be derived from the negative findings, especially what they may tell us about the design parameters of a good catalyst. The most effective catalyst developed to date, Catalyst 6 (Run 11677-11) of the Third Annual Report, was composed of Co/Th/X_4/UCC-103+UCC-101. This quarter's findings suggest three specifics of that catalyst which should prove useful in shaping further work. First, that the X_4 component is probably a key contributor to stability. Second, that the source of the X_4 is important; the X_4 must be free of known catalyst poisons, or have those poisons completely removed without impairing the cobalt Fischer-Tropsch activity. And third, that extra, physically mixed UCC-101 apparently contributes little if anything to stability. Eight of the twelve runs were devoted to tests of water gas shift catalysts in different formulations and methods of preparation, and under different operating conditions. Many attempts have been made to develop a copper-zinc water gas shift catalyst which will function effectively in combination with a Fischer-Tropsch catalyst and at the Fischer-Tropsch operating temperatures. The failure of these trials to date suggests that the water gas shift components may be deactivated by intermediates or products of Fischer-Tropsch synthesis. Yet attempts to isolate the water gas shift component from the Fischer-Tropsch products have been equally fruitless. 177 figs., 30 tabs.

25384 (DOE/PC/60805—T6) Cation promotion effects in zeolite-supported F-T catalysts. Sixth quarterly report, December 1984-February 1985. Goodwin, J.G. Jr.; Oukaci, R.; Feng, D. (Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering). Mar 1985. Contract FG22-83PC60805. 29p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85009969.

During this quarter, the TGA studies of ammonia adsorption carried out to determine the effect of alkali cations and Si/Al ratio of the various ion exchanged zeolites on the surface acidity have been completed. The results obtained from these measurements are presented. Also, during this quarter a new batch of ruthenium catalysts has been prepared. The same preparation method as described in the first quarterly report has been used except for the decomposition step prior to reduction with hydrogen. It has been frequently reported in the literature that the Ru-hexamine complex can be decomposed either under flowing helium or by degassing under vacuum at 673 K, the rate of heating being the major factor controlling the metal dispersion. However, as observed in the previous report, the first method (i.e. decomposition under flowing helium) produced rather low dispersed Ru-catalysts, except for the Ru/NaY catalyst. So, the Ru samples are decomposed under vacuum using a slow heating rate (0.5 K s^{-1}) up to 673 K in order to achieve higher metal dispersions. The characterization of these samples by H_2 and CO chemisorption is under progress. However, much higher dispersion was found for most of the catalysts characterized to date than for those decomposed under flowing helium. 19 refs., 18 figs., 3 tabs.

25385 (EUR—7814-EN) Certification of a second series of five hydrocarbon materials for the determination of equilibrium flashpoint (temperature ranges -10°C to +5°C and 80°C to 135°C). Lewis, D.J.; Gonska, H.; Karcher, W. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1984. 55p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

The closed cup flashpoints of five pure hydrocarbon materials (iso-octane, toluene, n-dodecane, n-tetradecane and n-hexadecane) have been determined by equilibrium methods in an interlaboratory exercise, involving twelve laboratories of the European Community member countries and one laboratory of the Commission of the European Communities. The methods used were based on IP303/74 (or ASTM D3278-73; Rapid Tester) and IP304/74 (Abel, Abel-Pensky, Pensky-Martens Cups) with extension to allow equilibrium conditions to be maintained outside the ranges of these methods. For each hydrocarbon material, the numbers of individual measurements accepted have been between 81 and 92. As a result, the closed cup flashpoints of these materials by an equilibrium method are certified at the following temperatures: CRM No. Hydrocarbon Equilibrium closed cup flashpoint 83 iso-octane -9.5 +- 0.5°C 84 toluene +6.0 +- 0.5°C 85 n-dodecane +81.0 +- 1.0°C 86 n-tetradecane +108.0 +- 1.0°C 87 n-hexadecane +133.5 +- 1.0°C. This report describes the experimental details of the interlaboratory measurements and the certification procedure. The procedure required extensions to be made to methods IP303/74 and IP304/74 which are given in detail and recommendations are made for the improvement of these methods over the temperature range covered by the flashpoint reference materials.

25386 (NP—5770270) Dimetal acyclopropane complexes as model compounds for Fischer-Tropsch synthesis. Strutz, H. (Technische Hochschule Aachen (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 14 Nov 1983. 148p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85770270.

Model reactions were established for the formation of oxygenous Fischer-Tropsch synthesis products and the incorporation of olefins during the FT reaction on the basis of methylene-bridged bimetal carbonyl complexes.

25387 (PB—85-171106/XAB) Landfill Methane Recovery. Part 3. Data analysis and instrumentation needs. Final report, January-September 1983. Zimmerman, R.E.; Lytwynyshyn, G.; Flynn, N.W. (ESCOR, Inc., Northfield, IL (USA)). Dec 1983. 91p. (REPT—544). NTIS, PC A05/MF A01.

See also PB83-195420.

This study expanded the level of data analysis for the existing volatile organic compound (VOC) data base from Landfill Methane Recovery Part II: Gas Characterization and determined the current instrumentation needs of the landfill methane recovery (LMR) industry. The VOC data analysis was conducted by statistically analyzing the Part II VOC data base using a computer-drive statistical package. The analysis consisted of data base review and corrections, analysis of data distribution within the data base, and analysis of trends and parameter correlation using statistical computations and general linear methods. The instrumentation survey included a survey of the LMR industry to determine current and anticipated trends and applications for LMR instrumentation, a survey of instrumentation manufacturers to determine the type of equipment commercially available, and the development of a computerized data base to match instrumentation needs with equipment availability. Results from this study indicate that these trace contaminants are effectively reduced in gas processed to high-Btu quality and that instrumentation is available for monitoring major and trace components in landfill gas. This instrumentation will enable gas utilities to maintain pipeline-quality gas, whether it is processed landfill gas going into the pipeline or natural gas from conventional sources.

25388 (PNL-SA—13008) Overview of the US Department of Energy's Biomass Thermochemical Conversion Program. Stevens, D.J. (Pacific Northwest Labs., Richland, WA (USA)). Feb 1985. Contract AC06-76RL01830. 5p. (CONF-8504120—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010965.

From 5. solar and biomass energy symposium; Atlanta, GA, USA (23 Apr 1985).

Biomass represents an important but underutilized energy resource in the United States. The Congressional Office of Technology Assessment has estimated that, with proper resource management and the development of efficient conversion processes, the potential contribution of biomass to US energy demand could range as high as 17 quadrillion Btu per year - almost 20% of current US energy consumption. Similarly, the Energy Research Advisory Board (ERAB) has estimated a potential of approximately 10 quadrillion Btu per year. Wood and crop residues constitute a vast majority of the biomass feedstocks available for conversion, and ther-

mochemical processes are well suited for conversion of these materials. The US Department of Energy (DOE) is sponsoring research on this conversion technology for renewable energy through its Biomass Thermochemical Conversion Program. The program is part of DOE's Biomass Energy Technology Division, Office of Renewable Energy. Pacific Northwest Laboratory has been designated the Field Management Office for the Biomass Thermochemical Conversion Program with responsibility for overall management of the program. This paper briefly describes the Thermochemical Conversion Program.

25389 **(PNL-SA—13123) Identifying the barriers to commercialization of low-Btu gasifiers: proceedings of a workshop.** Easterling, J.C.; Keenan, D.J.; Brenchley, D.L.; Russell, J.A. (Pacific Northwest Labs., Richland, WA (USA); National Wood Energy Association, Portsmouth, NH (USA)). Apr 1985. Contract AC06-76RL01830. 108p. (CONF-8411156—). NTIS, PC A06/MF A01; GPO Dep. File Number DE85011183.

From Workshop on identifying the barriers to commercialization of low BTU-gasifiers; Atlanta, GA, USA (27 Nov 1984).

Low-Btu gasification systems have the potential to use wood waste products to replace fossil fuels in many industrial applications. Because of this potential, the Pacific Northwest Laboratory (PNL) contracted with the National Wood Energy Association (NWEA) to organize and conduct a two-day low-Btu gasifier workshop as part of the Southeast Industrial Biomass Energy Exposition held in Atlanta, Georgia, in November 1984. The workshop objective was to have industrial manufacturers, users, and researchers involved with gasifiers (1) identify the most important problems that impede their widespread commercial use, and (2) recommend solutions to these problems. General sessions included presentations on the state-of-the-art for gasifier feeders and gasifiers design and application. The main activity of the workshop consisted of six working group sessions on the following technical issues: (1) status of feedstock and feeder technology; (2) cogeneration (status of turbine and piston engines applications); (3) performance and reliability requirements and related issues; (4) waste-stream cleanup and other environmental issues; (5) characterization, controls, and monitoring gas quality; and (6) industry/government R and D partnerships.

25390 **Studies on iron-manganese oxide carbon monoxide catalysts. I. Structure of reduced catalyst.** Jensen, K.B.; Massoth, F.E. (Univ. of Utah, Salt Lake City). *Journal of Catalysis;* **92**: No. 1, 98-108(Mar 1985).

Iron-manganese catalysts have been found to show enhanced selectivity for low-molecular-weight olefins from synthesis gas. These catalysts have been investigated using a number of characterization techniques including: BET surface area, selective chemisorption, x-ray diffraction, electron microscopy, temperature-programmed desorption/reduction, electron spectroscopy for chemical analysis (ESCA), and infrared spectroscopy. The principal phases of the reduced catalysts were found to be α-iron and manganese(II) oxide, with the manganese oxide phase containing some iron(II) oxide in solid solution. A significant fraction of the iron was covered by the MnO phase, even at low Mn contents. Evidence was found for both associative and dissociative CO adsorption. A structural model of the reduced catalyst is proposed, which at low Mn contents consists of basic iron particles containing small platelets of Mn at the surface, while at high Mn levels it consists of a mixture of these and bulk MnO particles containing small amounts of Fe at their surface. 23 refs., 3 figs., 4 tabs.

25391 **Studies on iron - manganese oxide carbon monoxide catalysts. II. Carburization and catalytic activity.** Jensen, K.B.; Massoth, F.E. (Univ. of Utah, Salt Lake City). *Journal of Catalysis;* **92**: No. 1, 109-118(Mar 1985).

Carburization studies of a series of reduced iron-manganese catalysts were done under synthesis gas (H_2/CO) conditions. Evidence was obtained for three types of carbon - carbidic, partially hydrogenated, and graphitic (coke-like carbon). These carbon types could be removed slowly with hydrogen; however, a relatively high temperature (500°C) was needed to remove all carbon. The low manganese oxide-containing catalysts showed greater specific activity for carbon monoxide and hexene hydrogenation than iron. The high manganese catalysts exhibited significantly increased hexene hydrogenation activity, possibly due to the presence of very small iron crystallites. Incorporation of manganese appears to chemically or electronically promote the active iron surface. In particular, it appears to alter the CO hydrogen reaction path by suppressing the direct formation of paraffins from the reactive intermediate, leading to higher olefins. 30 refs., 5 figs., 3 tabs.

0902 Alcohol Fuels

REFER ALSO TO CITATION(S) 25386

25392 **(DOE/PC/70780—T1) Trifunctional catalysts for conversion of syngas to alcohols. Second quarterly report, December 1, 1984-February 28, 1985.** Bischoff, K.B.; Manogue, W.; Mills, G.A. (Delaware Univ., Newark (USA). Center for Catalytic Science and Technology). 9 Apr 1985. Contract FG22-84PC70780. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010074.

The main accomplishment was completion of the construction and testing of the continuous-flow reaction system which is capable of operating at pressures up to 65 atmospheres. This consists of flow controllers for hydrogen, carbon monoxide and helium, gas purifiers; a reaction section and an on-line gas chromatographic analytical system. The analytical system has been calibrated with test mixtures of oxygenated compounds and hydrocarbons. Construction of a high-pressure spectral flow reactor is underway, involving modification of a previous unit. This will be used to determine catalyst surface complexes under reaction conditions using infrared spectroscopy. Several additional catalyst samples have been prepared. The literature review and discussions have continued so as to plan experiments most effectively. 4 figs.

25393 **(LUTKDH/TKKA—5009-1-12-(1983)) Distillation of ethanol containing byproducts from fermentation.** Eriksson, K. (Lund Inst. of Technology (Sweden). Dept. of Chemical Engineering). 1983. 28p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. File Number DE85750880.

When producing ethanol for fuel, a cheap process may be utilized, where the by-products from the fermentation (glycerol, isoamylic alcohol) are not separated before distillation. Laboratory experiments using this procedure are reported. The results prove that a good separation of the components in the mash is achieved in the distillation. The ethanol distillate contained aldehyds and trace amounts of glycerol and isoamylic alcohol besides the water. Effects of the aldehydes on the azeotropic distillation will be studied in the next stage.(G.B.).

25394 **(NYSERDA—85-4) Recycling of cellulase enzyme complex after cellulose hydrolysis. Final report.** Clesceri, L.S. (Rensselaer Polytechnic Inst., Troy, NY (USA)). Mar 1985. 84p. New York State Energy Research and Development Authority, Two Rockefeller Plaza, Albany, NY 12223. File Number TI85901378.

Cellulase enzymes have been recovered and recycled from steam-exploded wood (SEW) hydrolysis systems. This is accomplished by pH adjustment which elutes the enzymes from the spent wood coupled with readsorption of the soluble enzymes from hydrolysate. Adsorption of these enzymes onto new SEW can result in recovery of initial reaction rates. Enzyme recovery in systems in which SEW has been oven-dried is only half as complete as in systems that have remained moist. Enzyme recovery is also more effective in delignified systems than in systems with full lignin content. The effectiveness of enzyme recovery seems to be dependent on the degree of completion of SEW hydrolysis which is determined by time of contact and enzyme concentration. For cost-effective operation, it is recommended that the process of enzyme recovery not occur before FP and CMC (filter paper and carboxymethyl cellulase) activities are observed in the hydrolysate. 6 refs., 6 figs., 7 tabs.

25395 **(PB—85-152783/XAB) Survey of safety-related additives for methanol fuel. Final report, 18 July 1983-18 February 1984.** Fanick, E.R.; Smith, L.R. (Southwest Research Inst., San Antonio, TX (USA)). Nov 1984. 66p. NTIS, PC A04/MF A01.

This report describes the effort to determine what additives may be feasible for use with 100% methanol motor vehicle fuel to increase the safety associated with the use of methanol as a motor vehicle fuel. A survey of the literature was conducted to determine candidate additives that would (1) ensure methanol burns with a visible flame, (2) prevent improper use of the fuel as a degreaser or cleaning agent, (3) give the fuel an unpleasant taste causing expectoration of any methanol accidentally in one's mouth, and (4) act as an emetic. Candidate additives were evaluated as to effectiveness, cost, ease of production, health problems associated with the additive, and estimated effects on vehicle performance.

25396 **(STEV-BF—83-12) Bioconversion of cellulose to liquid fuel (ethanol). Final report, Stage 2, 1983-06-30.** Hahn-Haegerdal, B. (Statens Energiverk, Stockholm (Sweden)). 1983. 72p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. File Number DE85750899.

The process routes of the conversion have been investigated. The material which contains lignocellulose should be pretreated, and the separate processes are to be integrated. The price of raw materials and enzymes influences the process economy. The efficiency of biocatalysts on fermentation and saccharification are being studied and the reuse of enzymes is discussed. The process for the production of ethanol out of lignocellulose is shown to be very complicated. The optimization of the process will necessitate computerized simulation.

25397 **In situ x-ray diffraction investigation of the structural characteristics of two Co/ZSM-5 catalysts.** Dhere, A.G.; De Angelis, R.J. (Univ. of Kentucky, Lexington). *Journal of Catalysis;* **92**: No. 1, 145-154(Mar 1985). Contract AC22-81PC41760;AS05-82ER12098.

Two Co/ZSM-5 catalysts, one prepared by impregnation with a cobalt nitrate/water media and the other impregnated by cobalt carbonyl, were investigated employing an in situ x-ray diffraction chamber mounted on a diffractometer. X-ray diffraction patterns were obtained following each step in a sequence of processes on each catalyst. The water media-impregnated catalyst displayed the larger particle size and all characteristics remained constant following the initial reduction. The carbonyl-impregnated catalyst showed the formation of a large amount of CoO after exposure to H/CO gas of 1/1 composition at 200°C. Once the CoO formed it would continue to return after subsequent calcining and reduction treatments. 14 refs., 10 figs., 2 tabs.

25398 **Catalytic chemistry of low alcohol synthesis - following R.B. Anderson's lead.** Klier, K. (Department of Chemistry, Lehigh University, Bethlehem, PA). *Studies in Surface Science and Catalysis;* **19**: 439-455(Sep 1984). (CONF-8409183—).

From 9. Canadian symposium on catalysis; Quebec, Canada (30 Sep 1984).

The synthesis of alcohols from carbon monoxide, carbon dioxide, and hydrogen follows different pathways and leads to different product distributions over the copper-based and Group VIII metal containing catalysts. Methanol is selectively formed over the supported or unsupported Cu-ZnO catalysts and under certain conditions over palladium-based catalysts. The current knowledge of methanol synthesis mechanism based on isotopic labeling, chemical trapping, and spectroscopic experiments is reviewed.

25399 **Gasification of biomass for the production of methanol and ammonia.** Baker, E.G.; Brown, M.D.; Mudge, L.K. (Battelle Pacific Northwest Laboratory, Richland, WA). *AIChE National Meeting;* No. 18D, 14(Aug 1984). (CONF-840828—).

From International synfuels policies and technologies symposium; Philadelphia, PA, USA (19 Aug 1984).

Pacific Northwest Laboratory is developing a process for conversion of biomass to specific gas products. Biomass is reacted with steam or steam/air at high temperatures in the presence of catalysts. Specific gases that have been produced include methanol synthesis gas and ammonia synthesis gas. Gasification tests have been conducted in a laboratory-scale gasifier and in a 1-ton/day fluidized-bed process development unit. Maintaining catalyst activity in the fluidized-bed gasifier is the major remaining technical hurdle.

0904 Solid Waste And Wood Fuels

REFER ALSO TO CITATION(S) 25388, 25437, 25720, 25782

25400 **(AD-A—150814/2/XAB) Biomass feasibility study for Tennessee, Indiana, and Kansas Army Ammunition Plants.** Guinn, G.R.; Peters, J.F.; Ziemke, M.C. (Alabama Univ., Huntsville (USA). Kenneth E. Johnson Environmental and Energy Center; Georgia Inst. of Tech., Atlanta (USA)). Apr 1983. 124p. (UAH—357). NTIS, PC A06/MF A01.

Prepared in cooperation with Georgia Inst. of Technology.

The purpose of this study was to determine the feasibility of using solid biomass fuel instead of coal as boiler fuel at the Army Ammunition Plants (AAPs) at Parsons, Kansas, Milan, Tennessee, and Charlestown, Indiana. The study showed that only Milan AAP had a mature forest large enough to supply the Minimum Sustaining Rate (MSR) central boiler fuel but the delivered cost was greater than that of available coal. Only mill waste fuel (sawdust and bark) has a lower delivered price than coal at the three AAPs. At Milan AAP and Indiana AAP, adequate supplies of mill waste fuel are available to satisfy MSR central boiler fuel needs. No type of biomass fuel is practical at any of the AAPs for meeting central boiler fuel requirements for mobilization. Coal must be used as the primary fuel for this condition. Life cycle cost analyses of the entire central boiler plants at Milan AAP and Indiana AAP are necessary to determine if the use of sawdust and bark fuels is truly competitive with bituminous coal. Thus no biomass fuel can be recommended as a primary boiler fuel at any of the three AAP's at this time.

13 HYDRO ENERGY

25401 **(DOE/ID/12121—T1) Low-head hydroelectric power demonstration project: City of Gonzales, Texas. Final technical and construction cost report.** (Brown and Root Development, Inc., Houston, TX (USA)). Jan 1985. Contract FC07-80ID12121. 53p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85009919.

This project involved the restoration of a hydroelectric power plant and dam facility in Gonzales, Texas. The task was to dismantle and refurbish three existing turbines and to install new generators and electrical equipment. The awarding of contracts and costs of each piece of equipment are briefly discussed. After testing and additional adjustments the turbine efficiency was held between 7.4 and 10.1% below guaranteed output levels, yet a problem still remained in braking the turbines to a complete stop. (BCS)

1301 Resources And Availability

25402 **(AD-A—149941/7/XAB) Cooper River rediversion project. Lake Moultrie and Santee River, South Carolina. Intake and tailrace canals. Design Memo. No. 9.** (Army Engineer District, Charleston, SC (USA)). Jun 1976. 586p. NTIS, MF.

Original contains color plates. All DTIC and NTIS reproductions will be in black and white. See also Appendix A, AD-A149 732.

Conclusions include: (1) Studies performed for this report have adequately considered canal and interior drainage design alternatives; (2) The intake and tailrace canals alignment proposed in this report is the most economical alignment and has the least adverse environmental impact of alternatives considered; (3) The proposed interior drainage system is the most economical and feasible method of handling intercepted drainage of the alternatives considered; and (4) The canal design adequately considers earthquake effects on the canal and levee structures.

1305 Economics And Management

REFER ALSO TO CITATION(S) 25514

25403 **(AD-A—149775/9/XAB) Lock and Dam Number 1 hydropower study, Mississippi River at Minneapolis-St. Paul, Minnesota. Technical report.** (Army Engineer Div. North Pacific, Portland, OR (USA)). Oct 1984. 133p. NTIS, PC A07/MF A01.

This report determines the feasibility of adding hydropower generation to Lock and Dam Number 1, located on the Mississippi River in St. Paul, Minnesota. The existing project consists of a concrete Ambursen-type spillway section, two navigation locks on the right side of the river and an existing 14.4-mw hydro plant on the left side. The Corps owns and operates the dam and locks, while the Ford Motor Company owns and operates the hydro plant. This study shows that an additional powerplant can be built at the project that will more fully utilize the existing river flows. Four alternative powerplant locations were investigated. The selected powerplant will be 7.2-mw, single tubular unit, constructed at the spillway located near the existing powerplant. The new powerplant will produce 21.5 million kWh of annual generation. The total investment cost will be 11.5 million dollars. The project is economically feasibile with a benefit cost ratio of 1.12. The annual production cost will be 48 mills per kWh.

25404 **(AD-A—149943/3/XAB) Locks and Dam 1, Mississippi River, St. Paul/Minneapolis, Minnesota. Feasibility report for hydropower. Final report.** (Corps of Engineers, St. Paul, MN (USA). St. Paul District). Dec 1984. 319p. NTIS, PC A14/MF A01.

Supersedes AD-A129 840.

This report presents a detailed evaluation of additional hydropower potential at locks and dam 1. The original Federal navigation locks and dam project included a foundation for a hydropower plant to be developed by non-Federal interests. The existing hydropower plant and equipment are owned and operated by the Ford Motor Co. The existing four turbines generate a combined nameplate capacity of 14.4 MW (megawatts). This study was conducted under the assumption that the Federal government would develop additional hydropower at locks and dam 1. It concludes that an additional hydroelectric capacity of 7.2 MW would be the optimum amount that could be added to this site. That capacity would produce additional average annual energy of 21,450 MWh (megawatt-hours). The added energy recommended would equate to burning 36,500 barrels of oil or 10,000 tons of coal per year. Total investment first cost of the recommended hydropower development would be $11,696,000 or $1,076,000 on an average annual basis, including annual operation and maintenance costs. Average annual benefits based on the avoided costs of a fossil fuel plant are $1,325,000. Net annual benefits are $249,000. The benefit-cost ratio is 1.23 based on an 8-3/4% discount rate, 100-year project life, and October 1984 price levels. Many of the environmental impacts normally associated with hydropower development would not occur because no new impoundment or changed plan of regulating river flows would be required.

1306 Environmental Aspects

25405 **Balsam Meadow development of the Big Creek Project, FERC. No. 67, California.** *EIS (Environmental Impact Statements);* **6**: No. 11, 2(Nov 1982).

An abstract of the final environmental impact statement (EIS) on the construction of a 200 MW hydroelectric plant in Fresno County, California describes the effects of a 60-acre reservoir, 120-foot-high dam, a mile-long diversion tunnel, and other structures associated with power generation and distribution. The utility would benefit from the additional capacity, while the area would have new employment opportunities during the construction period and nearly one million dollars in new property tax revenue. Negative impacts include the loss of 80 acres of land, 97 acres of wildlife habitat, the diversion of lake water, and the loss of cultural and historical sites. Legal mandates for the EIS are the DOE Organization Act of 1977, Federal Power Act of 1920, and National Historic Preservation Act of 1966.

25406 **A.J. Wiley Hydroelectric Project, FERC No. 2845, Idaho.** *EIS (Environmental Impact Statements);* **6**: No. 11, 3-4(Nov 1982).

An abstract of the final environmental impact statement (EIS) for the Idaho hydroelectric project describes the facilities needed for the dam, spillway, ad powerhouse, the construction of a new bridge and roadway, power distribution structures, and a 625-acre reservoir. The area would benefit from the additional 70.5 MW capacity and the economic advantage of hydroelectric over coal-fired power. Employment opportunities would include 322 construction workers. The loss of free-flowing water for eight miles of the Snake River and the elevated water temperature and sediment content would affect fish resources. The impoundment would also affect the habitat of endangered species and damage prehistoric sites. Several laws covering historic preservation, power plants, rivers and harbors, and government land acquisition provide the legal mandate for the EIS.

14 SOLAR ENERGY

25407 **(DOE/R0/00498—T1) Lopez Energy Alternatives project. Final report.** Forbes, R.B. (Lopez Energy Alternatives, WA (USA)). [1985]. Contract FG06-80R000498. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010589.

The activities reported include: purchase of books and periodical subscriptions on energy-related topics for a community library; organization of energy-related workshops; and monitoring of solar radiation and wind. (LEW)

1401 Resources And Availability

REFER ALSO TO CITATION(S) 25762

1405 Solar Energy Conversion

REFER ALSO TO CITATION(S) 25372, 25373, 25374, 25375, 25376, 25379, 25382, 25388, 25389, 25393, 25394, 25396, 25717, 25776, 25884

25408 **(BNL—36269) Glow discharge deposition at high rates using disilane.** Rajeswaran, G.; Corderman, R.R.; Kampas, F.J.; Vanier, P.E. (Brookhaven National Lab., Upton, NY (USA)). 1985. Contract AC02-76CH00016. 12p. (CONF-8503106—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010236.

From Amorphous silicon subcontractors annual review meeting; Washington, DC, USA (21 Mar 1985).

The research program reported makes use of the fact that amorphous silicon films can be grown faster from disilane in a glow discharge than from the traditional silane. The goal is to find a method to grow films at a high rate and with sufficiently high quality to be used in an efficient solar cell. It must also be demonstrated that the appropriate device structure can be successfully fabricated under conditions which give high deposition rates. High quality intrinsic films have been deposited at 20 A/s. Efficiency of 5.6% on steel substrates and 5.3% on glass substrates were achieved using disilane i-layers deposited at 15 A/s in a basic structure, without wide-gap doped layers or light trapping. Wide gap p-layers were deposited using disilane. Results were compared with those obtained at Vactronic using high power discharges of silane-hydrogen mixtures. (LEW)

25409 **(DOE/ER/10098—T3) Fabrication and characterization of GaAs-Al/sub x/Ga/sub 1-x/As solar cells.** Polavarapu, M.S. (Howard Univ., Washington, DC (USA). Dept. of Electrical Engineering). Dec 1980. Contract FG05-78ER10098. 103p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85011083.

A liquid phase epitaxial system capable of growing good quality epitaxial layers of GaAs and Al/sub x/Ga/sub 1-x/As has been set up. Al/sub x/Ga/sub 1-x/As/GaAs solar cells have been fabricated using the structures grown with this system and they are characterized. The photovoltaic effect is reviewed, as well as the

equivalent circuit of a solar cell and its important parameters. The structure of a p(Al/sub x/Ga/sub 1-x/As)-p(GaAs)-n(GaAs) solar cell is described, and a theoretical analysis is presented. The expected cell performance for different minority carrier diffusion lengths, junction depths, alloy compositions and thicknesses are shown. The horizontal liquid phase epitaxy growth system is described and experimental procedures for preparing epitaxial layers of GaAs and Al/sub x/Ga/sub 1-x/As are detailed. The surface morphologies of the layers grown, the doping properties, the experimental and theoretical relationships between growth time, cooling rate, and thickness are also discussed. The fabrication procedure for the solar cells is described, and the properties of the cells are presented. (LEW)

25410 (DOE/ER/10961—1-Pt.A, pp 7-10) **Solar research in Israel.** Tabor, H. (Scientific Research Foundation, Jerusalem, Israel). 1982. The Weizmann Science Press of Israel, P.O. Box 801, Jerusalem 91007 Israel. File Number TI83015664. (CONF-8208106—Pt.A).

From 4. international conference on photochemical conversion and storage of solar energy; Jerusalem, Israel (8 Aug 1982).

The history of solar energy research in Israel dating back to the 1940's is reviewed and current research and development activities are highlighted. Current areas of research include bioconversion, photochemistry, and solar heating and cooling.

25411 (DOE/ER/10961—1-Pt.A, pp 63-74) **Hydrogen generating electrochemical solar cells.** Heller, A. (Bell Laboratories, Murray Hill, NJ). 1982. The Weizmann Science Press of Israel, P.O. Box 801, Jerusalem 91007 Israel. File Number TI83015664. (CONF-8208106—Pt.A).

From 4. international conference on photochemical conversion and storage of solar energy; Jerusalem, Israel (8 Aug 1982).

Photoelectrochemical cells currently represent the most efficient means for the direct conversion of sunlight to chemically stored energy. Their external efficiency, 12%, exceeds that of photosynthesizing organisms by an order of magnitude and approaches that of electrical power generating photovoltaic cells. Milestones passed on the way to development of these cells are reviewed.

25412 (DOE/ER/10961—1-Pt.A, pp 75-80) **Photosensitized reactions on surfaces.** Honda, K. (Univ. of Tokyo, Japan). 1982. The Weizmann Science Press of Israel, P.O. Box 801, Jerusalem 91007 Israel. File Number TI83015664. (CONF-8208106—Pt.A).

From 4. international conference on photochemical conversion and storage of solar energy; Jerusalem, Israel (8 Aug 1982).

The electrochemical behavior of photo-excited molecules at a solid-liquid interface as occurs in dye sensitization processes on semiconductor electrodes is discussed.

25413 (DOE/ER/10961—1-Pt.A, pp 81-114) **Transformation of light energy into chemical energy. III. Some aspects of photogalvanic cells.** Calzaferri, G. (Univ. of Bern, Switzerland). 1982. The Weizmann Science Press of Israel, P.O. Box 801, Jerusalem 91007 Israel. File Number TI83015664. (CONF-8208106—Pt.A).

From 4. international conference on photochemical conversion and storage of solar energy; Jerusalem, Israel (8 Aug 1982).

The equilibrium situation and the photostationary state in the photochemistry of photogalvanic cells are examined. It is shown that cells in which heterogeneous photoreactions from products which can react at the electrodes offer more possibilities than those employing homogeneous reactions.

25414 (DOE/ER/10961—1-Pt.A, pp 115-138) **Elementary processes in catalytic reactions at the interface between colloidal microelectrodes and solutions.** Henglein, A. (Hahn-Meitner-Institut fuer Kernforschung Berlin, West Germany). 1982. The Weizmann Science Press of Israel, P.O. Box 801, Jerusalem 91007 Israel. File Number TI83015664. (CONF-8208106—Pt.A).

From 4. international conference on photochemical conversion and storage of solar energy; Jerusalem, Israel (8 Aug 1982).

The use of colloidal microelectrodes to catalyze photochemical and radiochemical reactions is discussed. Topics covered include general reaction schemes, absorption and fluorescence, photodegradation of colloidal sulfides, flash photolysis studies on colloidal ZnS and CdS, reactions on colloidal TiO_2, catalysis of free radical reactions at silver microelectrodes, and radical reactions at other metal electrodes.

25415 (DOE/ER/10961—1-Pt.A, pp 139-162) **Photoelectron transfer in organized assemblies.** Moebius, D. (Max-Planck-Institut fuer Biophysikalische Chemie, Goettingen, West Germany). 1982. The Weizmann Science Press of Israel, P.O. Box 801, Jerusalem 91007 Israel. File Number TI83015664. (CONF-8208106—Pt.A).

From 4. international conference on photochemical conversion and storage of solar energy; Jerusalem, Israel (8 Aug 1982).

The order and controlled molecular dynamics in organized assemblies of organic compounds exhibiting photoinduced electron transfer processes are discussed. Polyelectrolytes, micelles, bilayer lipid membranes, and modified electrodes are covered in the discussion.

25416 (DOE/ER/10961—1-Pt.A, pp 161-204) **Oxidation-reduction photochemistry of metal complexes in solution.** Maverick, A.W.; Che, C.M.; Nocera, D.G.; Winkler, J.R.; Gray, H.B. (California Institute of Technology, Pasadena, CA). 1982. The Weizmann Science Press of Israel, P.O. Box 801, Jerusalem 91007 Israel. File Number TI83015664. (CONF-8208106—Pt.A).

From 4. international conference on photochemical conversion and storage of solar energy; Jerusalem, Israel (8 Aug 1982).

Storage of solar energy in chemical form through oxidation-reduction reactions in various metal complexes in aqueous solutions is discussed.

25417 (DOE/JPL/956334—1) **Block V documentation and solar modules. Final report.** (Spire Corp., Bedford, MA (USA)). 28 Feb 1985. Contract NAS-7-100-956334. 28p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85011272.

Design and fabrication of Spire Corporation's Block V photovoltaic flat-plate module is reviewed. These modules exhibited power of about 70 watts under standard test conditions. Results of performance and environmental testing are provided.

25418 (DOE/JPL/957031—85/2) **Ink jet printing of silver metallization for photovoltaics. Quarterly technical report, January 1-March 31, 1985.** Vest, R.W. (Purdue Univ., Lafayette, IN (USA). Turner Lab. for Electroceramics). 22 Apr 1985. Contract NAS-7-100-957031. 33p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85011142.

The development of an ink jet printing system for solar cells is reported. It was decided to implement some kind of computer aided design capability into the system and to increase the printing speed, which requires programming acceleration and deceleration into table movements. Several improvements to the ink supply and pressure control system are reported. Some preliminary printing studies were started. (LEW)

25419 (EUR—9114-EN) **Genetic manipulation of photosystem I and II.** Wettstein, D. von; Lindberg Moeller, B.; Hoeyer-Hansen, G.; Bordier Hoej, P.; Simpson, D.J.; Henry, L.E.A.; Koenig, F.; Hoenberg, L.; Poulsen, C. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1984. 20p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

With 55 refs.

The lamellar system of the chloroplasts is composed of flattened sacs, thylakoids, and these carry out the primary processes of photosynthesis. The assembly of the photosynthetic membrane requires an intimate cooperation between the genes in the nucleus and those in the chloroplast DNA. As stipulated in the contract, our efforts have been concentrated towards the collection of further information on the following subjects: The isolation of functionally active photosystem I and II preparations of simple polypeptide

composition and functional characterization of their component polypeptides. Isolation and characterisation of new nuclear gene mutants in barley. Exploitation of monoclonal antibodies raised against interesting thylakoid polypeptides. Localization and primary structure of genes in the nuclear and chloroplast DNA coding for selected thylakoid polypeptides.

25420 **(NP—5770197) Space know-how in electrical systems.** (AEG-Telefunken Anlagentechnik, Wedel (Germany, F.R.). Fachbereich Raumfahrt, Neue Technologien). 15 Sep 1984. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85770197.

Special issue space report.

The article reviews AEG activities in the field of solar technology, with special reference to solar cell systems for satellites.

25421 **(NYSERDA—85-1) Nitrogen fertilizer and sewage sludge effects on hybrid poplars. Final report.** Riha, S.R.; Senesac, G.P.; Naylor, L. (Cornell Univ., Ithaca, NY (USA). Dept. of Agricultural Engineering). Jan 1985. 87p. New York State Energy Research and Development Authority, Two Rockefeller Plaza, Albany, NY 12223. File Number TI85901397.

Experiments conducted in the greenhouse compared the growth and nutrient and heavy metal uptake in two clones of hybrid poplar grown in soil amended with nitrogen fertilizer or sewage sludge. In addition, poplar responses to weed competition and to rooting prior to planting were investigated. Both fertilizer and sludge application increased poplar stem biomass. Weeds reduced poplar biomass. The large difference in root biomass of the two poplar clones may account for different effects weed and sludge application had on nutrient and heavy metal uptake in each clone. The relatively small root biomass of I-45/51 increased with increasing sludge application, as did the uptake of nutrients and heavy metals. The relatively large root biomass of clone NE-510 was reduced when weeds were present, as was nutrient and heavy metal uptake. Other results suggest that poplars with low root-to-stem ratios may be most affected by weed competition, especially after their first year, and that nitrogen fertilization may alleviate effects of weeds on their growth. Poplars grown in sludge-amended soil did not accumulate more of any nutrient or heavy metal studied compared to those grown in nitrogen-fertilized soil. 17 refs., 5 figs., 57 tabs.

25422 **(SAND—85-0449C) Using PVFORM, a systems performance model, to determine optimum mounting configurations for flat-plate photovoltaic modules.** Menicucci, D.F. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 16p. (CONF-850606—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE85011191.

From American Society of Heating, Refrigerating and Air-Conditioning Engineers' semiannual meeting; Honolulu, HI, USA (23 Jun 1985).

The performance of a photovoltaic (PV) system is affected by the particular mounting configuration selected. But the optimal configuration for various potential designs is unknown because too few PV systems have been fielded. Sandia National Laboratories (SNLA) is currently conducting a controlled field experiment in which four of the most commonly used module mounting configurations are being compared. The data from the experiment are used to verify the accuracy of PVFORM, a new PV performance model. The model is then used to simulate the performance of PV modules mounted in different configurations in eight sites throughout the US. This paper describes the module mounting configurations, the experimental methods used, the specialized statistical techniques used in the analysis and the final results of the effort. The module mounting configurations are rank ordered at each site according to their energy production performance and each is briefly discussed in terms of its advantages or disadvantages in various applications.

25423 **(SERI/RR—211-2707) Research progress in the DOE/SERI Amorphous Silicon Research Project.** Sabisky, E.; Wallace, W.; Stafford, B.; Sadlon, K.; Luft, W. (Solar Energy Research Inst., Golden, CO (USA)). Apr 1985. 8p. NTIS, PC A02/MF A01. File Number DE85008796.

The Amorphous Silicon Research Project (ASRP), established at the Solar Energy Research Institute (SERI) in 1983, is responsible for all USDOE government-supported research activities in the field of amorphous silicon photovoltaics. The objectives and research directions of the project have been established by a Five-Year Research Plan developed at SERI in cooperation wiht the Department of Energy in 1984. In order to accomplish project goals, research is performed by a combination of (1) multi-year programs consisting of multi-disciplinary research teams based on strong government/industry partnerships and (2) basic research performed in university, government, and industrial laboratories. A summary of recent research progress in the ASRP program is presented.

25424 **(SERI/SP—271-2532) Electricity from sunlight: the emergence of photovoltaics. Revised Edition.** Flavin, C. (Solar Energy Research Inst., Golden, CO (USA); Worldwatch Inst., Washington, DC (USA)). Dec 1984. Contract AC02-83CH10093. 48p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85002920.

After a brief review of the history of the early development of photovoltaic technology, the economics of photovoltaic power and the growth of the photovoltaic industry are discussed. Applications of photovoltaic systems, present and future are described, including use in remote villages, in homes, and in industries. Expected future developments are discussed. 98 refs. (LEW)

25425 **(SERI/STR—211-2449) Investigation of a-Si and related semiconductors as materials for photovoltaic conversion. Final subcontract report, 1 September 1982-31 August 1983.** Paul, W.; MacKenzie, K.; Weisfield, R. (Harvard Univ., Cambridge, MA (USA). Div. of Applied Sciences). Dec 1984. Contract AC02-83CH10093. 85p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85002932.

This report comprises four sections - each one describing research done at Harvard University on amorphous silicon for photovoltaic uses. Section I describes a new glow discharge apparatus constructed at Harvard and initial efforts to use it to fabricate films of a-Si:H. Section II describes a new analysis of space-charge-limited current measurements to obtain density of gap states results. Section III contains a description of preliminary film properties of a-Si:H, doped a-Si:H, and a-SiGe:H films produced in the new glow discharge system. Section IV presents more complete data on the films and describes improvements made to the discharge apparatus.

25426 **(SERI/STR—211-2450) Chemistry and physics of silicon-based amorphous semiconductors.** Brodsky, M.H.; Scott, B.A. (International Business Machines Corp., Yorktown Heights, NY (USA). Thomas J. Watson Research Center). Dec 1984. Contract AC02-83CH10093. 37p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85002931.

This report summarizes the work done under a multi-phased IBM subconstract with the Solar Energy Research Institute. A major thrust of this research was HOMOCVD film growth. This phase of the work concentrated on material properties of a-Si:H and a-Ge:H, and a comparison of these properties with films produced by the glow discharge process. Measurements suggest that HOMOCVD films are less disordered than plasma-deposited a-Si:H, with other material properties being comparable. Schottky barrier devices were made with HOMOCVD a-Si:H, and an external J/sub sc/ of 6 mA/cm^2 under AM 1 was measured, along with a V/sub oc/ of 508 mV. A diffusion length of 0.4 μm was estimated from quantum efficiency measurements. Some discussion of plasma physics in a HOMOCVD deposition process is presented. Other areas of research investigated under this contract are window-type materials prepared from silane-phenylsilane mixtures and theoretical investigations of the causes of disorder in a-Si:H.

25427 **(SERI/STR—211-2504) Research on the basic understanding of high efficiency in silicon solar cells. Semiannual report, December 1, 1983-June 1, 1984.** Rohatgi, A.; O'Keeffe, T.W.; Yoldas, B.E.; Meier, D.L.; Schmidt, D.N.; Rai-Choudhury, P. (Westinghouse Research and Development Center, Pittsburgh, PA (USA)). Mar 1985. Contract AC02-83CH10093. 54p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85008774.

This report presents the progress of research done to develop a basic understanding of high-efficiency silicon solar cells and achieve cell efficiencies greater than 18% by employing innovative concepts of material preparation, cell design, and fabrication technology. Part of program is geared to developing models for very high-efficiency cell designs, experimentally verifying the designs, and improving understanding of efficiency-limiting mechanisms such as heavy doping effects and bulk and surface recombination.

25428 **(SERI/STR—211-2514) Photoelectronic properties of zinc phosphide crystals and heterojunctions. Final report, September 1, 1983-March 31, 1984.** Bube, R.H.; Fahrenbruch, A.L.; Casey, S. (Stanford Univ., CA (USA)). Mar 1985. Contract AC02-83CH10093. 41p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85008777.

This report presents progress in an investigation of the photoelectronic properties of zinc phosphide (Zn_3P_2) in single-crystal, polycrystalline, and heterojunction form to understand the phenomena occurring at the surface of Zn_3P_2 and at junction interfaces so that photovoltaic performance could be improved. It was found that the resistivity of the polycrystalline samples could be reduced by heat treatments. Results of junctions made with Ti, Zr, Y, Th, Au, Pd, and Mg on Zn_3P_2 are presented. Only Mg formed good diodes. Excellent Mg/Zn_3P_2 diodes were formed on polished, etched Zn_3P_2 surface, even when the surface appeared to be uniform. Electron-beam induced current images showed variations in minority carrier lifetime which might explain the variations in diode behavior. Surface photovoltage measurements indicated that the typical surface photovoltages for polished or polished and etched Zn_3P_2 are much smaller than those measured for other p-type semiconductors.

25429 **(SERI/STR—211-2515) Zn_3P_2 as an improved semiconductor for photovoltaic solar cells. Final report, April 1, 1983-March 31, 1984.** Bhushan, M.; Meakin, J.D. (Delaware Univ., Newark (USA). Inst. of Energy Conversion). Mar 1985. Contract AC02-83CH10093. 61p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85008772.

Development efforts have been made on two heterojunctions with Zn_3P_2; namely, Zn_3P_2/ZnSe and Zn_3P_2/(CdZn)S. In both cases, improved open-circuit voltages were achieved, but control of the material properties of the heterojunction partner has limited short-circuit currents and overall efficiency. In the case of ZnSe, the high resistivities of deposited thin-films were efficiency-limiting on all devices. In the case of (CdZn)S, it is concluded that high interface recombination rates are controlling the short-circuit current and limiting the overall efficiency. A more fundamental study of the Zn_3P_2/(CdZn)S heterojunction will be necessary in order to make further optimization of this device possible.

25430 **(SERI/STR—211-2546) Cadmium sulfide/copper ternary heterojunction cell research. Final subcontract report.** Mickelsen, R.A.; Devaney, W.E.; Chen, W.S.; Hsiao, Y.R.; Stewart, J.M.; Olsen, L.C.; Rothwarf, A. (Boeing Aerospace Co., Seattle, WA (USA)). Mar 1985. Contract AC02-83CH10093. 310p. NTIS, PC A14/MF A01; 1; GPO Dep. File Number DE85008778.

The properties of polycrystalline, thin-film $CuInSe_2$/CdS and $CuInSe_2$/(Cd,Zn)S solar cells prepared by vacuum evaporation techniques are described. First results are presented on preparation of CuIn/sub 1-x/Ga/sub x/Se_2 polycrystalline thin-films and CuIn/sub 1-x/Se_2/CdS photovoltaic devices. X-ray diffraction and photoluminescence results on the films are given. Current-voltage and spectral response measurements are reported on CuIn/sub 1-x/Ga/sub x/Se_2/CdS devices that show the higher V/sub oc/ and wider band gap expected. Experiments on annealing of $CuInSe_2$ in H_2Se which produced grain sizes of up to 20 μm are reported. Thermally stimulated capacitance, isothermal capacitance transient spectroscopy, and a new transient capacitance technique applied to $CuInSe_2$/CdS cells are described. Application of film and device analysis techniques (SEM, EDS, EBIC, and laser spot scans) are described. Low-temperature photoluminescence of $CuInSe_2$ films is discussed along with a proposed energy level model. Results of epitaxial deposition, ionized cluster beam deposition, and deposition of $CuInSe_2$ in an oxygen ambient are discussed. Loss analysis results and reports pertaining to cell analysis and theoretical cell mechanism studies are presented.

25431 **(SERI/STR—211-2556) Research on electrochemical photovoltaic cells. Final report, 1 July 1982-30 April 1983.** Tench, D. (Rockwell International Corp., Thousand Oaks, CA (USA). Science Center). Mar 1985. Contract AC02-83CH10093. 76p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85008775.

This report contains results of research conducted to provide a basis for designing a practical electrochemical solar cell based on the II-VI compound semiconductors. Emphasis was on developing new solvent/redox systems and conducting films that will stabilize the II-VI compounds against photodissolution without seriously degrading the long-term solar response and on applying electrochemical photocapacitance spectroscopy (EPS) to the development of improved thin-film materials. In photoelectrode stabilization, work focused on electrodeposited polypyrrole to determine the effects of the deposition parameters on the film density and electrical conductivity. These film properties were found to vary dramatically with the substrate, deposition conditions, electrolyte and anion employed, indicating there is considerable leeway for improvement. The most dense and highly conductive films have involved polymeric anions, nonaqueous solvents, and metallic substrates. A promising approach to providing an improved surface for polymer deposition on semiconductors has been identified. In the EPS area, the focus was on the development of thin-film CdSe materials.

25432 **(SERI/STR—211-2638) Electrohydrodynamic process for the production of large area polycrystalline silicon sheet. Final subcontract report.** (Phrasor Scientific, Inc., Duarte, CA (USA)). Mar 1985. Contract AC02-83CH10093. 75p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85008781.

This report describes the development of a novel method for depositing silicon films on various substrates using an accelerated beam of micron-sized droplets. Since the work reported here, an improved droplet source that employs melting without a crucible has been demonstrated. This source ensures that a high-purity film can be deposited. In view of the progress of competing film growth technologies, the economics of electrohydrodynamically (EHD) produced polycrystalline sheet is suspect. The fine grains of the EHD-deposited films suggest that the technology may be used to explore the potential for producing amorphous-like films by backfilling hydrogen gas in the chamber during the atomization process.

25433 **(SERI/TP—211-2378) Recent improvements in materials for thin GaAs and multibandgap solar cells.** Benner, J.P. (Solar Energy Research Inst., Golden, CO (USA)). May 1985. Contract AC02-83CH10093. 11p. (CONF-840804—56). NTIS, PC A02/MF A01; GPO Dep. File Number DE85008800.

From Intersociety energy conversion engineering conference; San Francisco, CA, USA (19 Aug 1984).

The High Efficiency Concepts Program at SERI supports research on III-V compound semiconductors with the objective of achieving the maximum attainable photovoltaic conversion efficiencies for terrestrial solar electric power. The outcome of this research may also affect the future of space photovoltaic cells. While the interest in thin-film, high-efficiency solar cells for terrestrial applications is driven principally by consideration of system costs, such cells would also improve the power density of space power arrays.

25434 **(SERI/TP—212-2697) Current status of silicon materials research for photovoltaic applications.** Ciszek, T.F. (Solar Energy Research Inst., Golden, CO (USA)). Apr 1985. Contract AC02-83CH10093. 11p. (CONF-8504109—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85008799.

From SPIE technical symposium - East '85; Arlington, VA, USA (8 Apr 1985).

The desire for high solar cell efficiencies has been a strong factor in determining the course of recent silicon crystal growth research efforts for photovoltaics. This review, therefore, focuses on single-crystal, dislocation-free ingot growth methods (Czochralski growth, float zoning, and cold crucible growth) and on sheet growth technologies, generally multicrystalline, that have achieved moderately high (>13.5%) laboratory-scale efficiencies. These include dendritic web growth, growth from capillary dies, edge-supported pulling, ribbon-against-drop growth, and a recent technique termed crucible-free horizontal growth. Silicon ribbon crystals provide a favorable geometry and require no wafering, but they contain defects that limit solar cell performance. Growth processes, their current status, and cell efficiencies are discussed. Silicon material process steps before and after crystal growth are described, and the advantages of silicon are presented.

25435 **(SLU-ISK—154) Long range forestry planning. A case study of a forest in a transition period.** Eriksson, L.O. (Swedish Univ. of Agricultural Sciences, Garpenberg. Dept. of Operational Efficiency). 1983. 89p. (In Swedish). NTIS (US Sales Only), PC A05/MF A01. File Number DE85750891.

A model for long range forestry planning is presented. The forestry data is prepared by aggregating the stands into timber classes by cluster analysis. Projections are made in a stand simulation model and the planning problem is solved with a linear programming model. An application is given for a problem on three forest districts of the Swedish Forest Service. It is shown that major attention has to be paid to the thinnings, which will increase substantially over the 35 years that is studied. How they, and other activities in the forests, should be managed is shown to depend on what objectives are to be attained and what assumptions are made on future developments.(author).

25436 **(STEV-EO—84-7) Fuels from agriculture. Report stage 4 1981-1983.** Renborg, U. (Statens Energiverk, Stockholm (Sweden)). 1984. 171p. (In Swedish). NTIS (US Sales Only), PC A08/MF A01. File Number DE85750900.

In 3 parts.

The aim of the project is to identify possible fuel crops in agriculture and which energy carriers can be produced from these raw products. Surveys are made of the yields of various energy crops under different production conditions. Studies are also made of systems for cultivation, harvesting, handling and processing of the raw products. The chemical properties of the fuel crops with regard to different ranges of use are also analysed. Studies have also been made of the economic conditions concerning energy crops from the perspectives of the user, the grower and society. Different environmental consequences of growing and using energy crops are studied. The studies are mainly concentrated on the following crops: grain and sugar-rich root crops for production of ethanol; oilseed crops for production of vegetable oil; straw, energy grass and energy forestry (wood from shortrotation forests) to be used as solid fuels; and possibilities of producing biogas from crops such as lucerne, jerusalem artichoke, etc., with high yields of biomass are being tested. The economic analyses show that solid fuel from agriculture is capable of competing with fuel oil in heating plants with an effect of 0.2-1.0 MW. As regards cost, straw is also capable of competing with other kinds of fuel oils, forest fuels and peat. If we consider prevailing taxation conditions, a competetive alternative might be a restricted admixture of ethanol as a means of increasing the octane rating in petrol. However, this is under the condition that the by-products are fully utilized and can be marketed at the current market prices of protein feeds. Under conditions prevailing today, vegetable oil cannot compete with diesel oil.

25437 **(STEV-FBA—84-15) Technology for handling biofuels of different qualities at combustion plants for solid fuels.** Stridsberg, S. (Statens Energiverk, Stockholm (Sweden)). Feb 1984. 97p. (In Swedish). NTIS (US Sales Only), PC A05/MF A01. File Number DE85750884.

With the reintrodution of solid fuels in Sweden during the last years, problems have been encountered due to inadequate specifications of the fuels and to uncertainties concerning the equipment for handling solid fuels. This report gives descriptions of such equipment and presents some overall solutions for handling solid fuels at combustion plants of different size. The handling includes reception, storge and transport of the fuel. The most frequent problems include: arching at the reception hopper, underdimensioned conveyors and inadequate control of the fuel flow. Cost estimates are given for the handling of biofuel of various qualities (chips, powders and pellets). As a rule of the thumb, handling cost of 10 % of the fuel price is reasonable. Uncertainties remain, however, concerning the cost for maintenance of the systems.(G.B.).

25438 **(STEV-SB—84-2) Shear-type cutter.** Karlsson, E. (Statens Energiverk, Stockholm (Sweden)). 1984. 16p. (In Swedish). NTIS (US Sales Only), PC A02/MF A01. File Number DE85750897.

During the initial phase of the development work a series of tests were performed in order to verify the design principles of the harvester head. Later, a prototype was constructed. Field tests and evaluation of the prototype will be made in the near future.

25439 **Polycrystalline thin-film Cu/sub 2-x/Se/CdS solar cell.** Chen, W.S.; Stewart, J.M.; Mickelsen, R.A. (Boeing Aerospace Company, Seattle, Washington 98124). *Applied Physics Letters;* **46**: No. 11, 1095-1097(1 Jun 1985).

The development of a polycrystalline thin-film solar cell utilizing a backwall designed heterojunction structure based upon p-type Cu/sub 2-x/Se and n-type CdS semiconductor materials is described. The electrical, optical, and structural properties of the deposited thin-film materials are described. A device efficiency of 5.38% under simulated AM1 illumination is reported.

25440 **Neutron damage effects in AlGaAs/GaAs solar cells.** Barnes, C.E.; Wiezer, J.J. (Sandia National Laboratories Albuquerque, NM 87185). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-31**: No. 6, 1471-1476(Dec 1984).

Certain anticipated space radiation environments in which electronic devices must operate include significant neutron fluences. We have measured the effects of neutron irradiation on the performance of AlGaAs/GaAs solar cells. At wavelengths greater than 700 nm, there is an initial, rapid decrease in quantum efficiency with neutron fluence followed by a much more gradual decline. While the degradation at shorter wavelengths is more uniform, it can be significant, especially in 20% Al containing active region cells. In general, the results demonstrate important differences and similarities between proton and neutron irradiation effects.

25441 **Excitation transport and trapping in a two-dimensional disordered system: cresyl violet on quartz.** Anfinrud, P.; Crackel, R.L.; Struve, W.S. (Iowa State Univ., Ames). *Journal of Physical Chemistry;* **88**: No. 24, 5873-5882(22 Nov 1984). Contract W-7405-ENG-82.

Picosecond photon counting fluorescence profiles have been evaluated for cresyl violet (CV) adsorbed on amorphous quartz with submonolayer coverages ranging over more than two orders of magnitude. A number of model functions for the time-dependent fluorescence intensity have been tested by nonlinear least-squares convolute-and-compare analysis of the profiles. The autocorrelation functions of the resulting residuals provide a sensitive criterion for the model functions. Convolutions of single-exponential, biexponential, and two-dimensional Forster-type decay models with the instrument function yield poor autocorrelations, while a fluorescence intensity model function yields autocorrelation functions which are dominated by statistical noise. The observed long-time fluorescence decay at most coverages is consistent with emission by adsorbed CV monomers, with time dependence governed by two-dimensional excitation trapping by CV dimers. No conclusive evidence for

CV dimer fluorescence is found. CV orientational diffusion on the surface is shown to be unimportant. The range of applicability of the Loring-Fayer two-body approximation to the master equations for energy transport and trapping in two-dimensional disordered systems has been examined for our CV coatings on quartz and is found to be marginally valid for the lowest coverage studied, for which the reduced dimer (trap) density is less than 0.25.

25442 **Polymer blends for use in photoelectrochemical cells for conversion of solar energy to electricity.** Skotheim, T. (to Dept. of Energy). US Patent Application 6-655,489. 28 Sep 1984. 21p. Contract AC02-76CH00016.

There is disclosed a polymer blend of a highly conductive polymer and a solid polymer electrolyte that is designed to achieve better charge transfer across the conductive film/polymer electrolyte interface of the electrochemical photovoltaic cell. The highly conductive polymer is preferably polypyrrole or poly-N-p-nitrophenylpyrrole and the solid polymer electrolyte is preferably polyethylene oxide or polypropylene oxide.

25443 **Process design and economic evaluation for the production of glucose from enzymatic hydrolysis of acid pretreated mixed hardwood.** Allen, D.C.; Converse, A.O.; Grethlein, H.E. (Thayer School of Engineering, Dartmouth College, Hanover, NH). *Solar Energy;* 33: No. 2, 175-186(1984).

A basic process plant design is presented which has a production capacity of 1060 tons of glucose per day. The processing scheme for converting mixed hardwood to glucose consists of a mild acid hydrolysis pretreatment of the substrate in a continuous plug flow reactor, followed by enzymatic hydrolysis in a batch stirred reactor. As the slurry concentration varies from 10 to 20 percent in the enzymatic hydrolysis, the glucose yields change from 91.4 to 74 percent, respectively. The costs of producing glucose per pound in an aqueous solution with a substrate cost of 2 /lb are given for each design and range from 13 to 16 /lb. Since the concentration of glucose is different in each design, an additional cost of bringing each design to at least 10 percent glucose is given. A cost sensitivity study is presented. Also, the cost of straight acid hydrolysis with 56 percent glucose yield is compared to this 2-stage process.

25444 **Excited-state electron transfer.** Meyer, T.J. (Univ. of North Carolina, Chapel Hill). *Progress in Inorganic Chemistry;* 30: 389-440(1983).

This review article has its basis in that connection between electron transfer and photochemistry which came about as it was noted that much of the theoretical background for electron transfer has its basis in radiationless decay theory. The first part of the review deals with electron transfer theory, and the second part discusses applications of the theory to photochemical and photophysical processes. 104 references.

1406 Photovoltaic Power Systems

REFER ALSO TO CITATION(S) 25424, 25474

25445 (MRI/SOL—1101, pp 275-290) **Performance of 1100 kWh battery units integrated with photovoltaic power system.** Khoshaim, B.H. (SOLERAS, Riyadh, Saudi Arabia). 1982. NTIS, PC A19/MF A01. File Number DE84015232. (CONF-820312—; SERI/CP—270-1521).

From Solar storage workshop; Jeddah, Saudi Arabia (21 Mar 1982).

This paper presents the performance characteristics of the 1100 kWh battery units within one of the projects the Saudi Solar Village, sponsored by the Saudi Arabian - US Program for Cooperation in the field of Solar Energy (SOLERAS). The one hundred million dollar program is funded equally by both nations over five years (1978-1983) to support the development and application of energy technologies in both countries. The program scope includes photovoltaic power generation for small villages, to a solar assisted, self sufficient, agricultural project, to the development of solar cooling facilities and solar water desalination projects. The program thus is intended to accelerate the emergence of economical solar technologies suitable for use in many countries throughout the world.

25446 (MRI/SOL—1101, pp 395-398) **Solar energy research program: Kuwait Institute for Scientific Research.** Kellow, M. (Kuwait Institute for Scientific Research, Safat). 1982. NTIS, PC A19/MF A01. File Number DE84015232. (CONF-820312—; SERI/CP—270-1521).

From Solar storage workshop; Jeddah, Saudi Arabia (21 Mar 1982).

The solar research program at the Kuwait Institute for Scientific Research (KISR) started in 1976 with the establishment of the Solar Energy Department. The program activities presently focus on the following areas: 1) solar cooling and heating of buildings; 2) desalination of seawater; 3) electric power generation utilizing solar thermal conversion; 4) agricultural applications; 5) photovoltaic development and applications; and 6) climatic data collection. Specific projects are under way in each of the areas above allowing for technology adaptation as well as the development of indigenous technology in solar energy.

25447 (MRI/SOL—1101, pp 399-416) **Solar village of Cacuri.** Mayer, E.R.; Grillet, N. (Univ. Simon Bolivar, La Guaira, Venezuela). 1982. NTIS, PC A19/MF A01. File Number DE84015232. (CONF-820312—; SERI/CP—270-1521).

From Solar storage workshop; Jeddah, Saudi Arabia (21 Mar 1982).

The need for a more rational use of the land where space, water, energy, and mineral resources are available in Venezuela has induced the national utility company (CADAFE) and the government of the federal territory of Amazon to test the use of renewable energy sources in a remote village of the federal territory of Amazon. Various photovoltaic generators are used to operate some of the basic services of the community (dispensary, radioemitter, etc.). This installation, designed by the authors, has been operating successfully since June 1981.

1407 Solar Thermal Power Systems

REFER ALSO TO CITATION(S) 25446

25448 **(DOE/DR/00789—T110) IEA Small Solar Power Systems project: operation status report, December 1984.** (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Stuttgart (Germany, F.R.)). 27 Feb 1985. Contract AC04-76DR00789. 26p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85009820.

The test and operation phase of the Small Solar Power Systems project is reported for the period from October 1984 through December 1984. The operation of the distributed collector system and the central receiver system and the testing of heliostats are reported. (LEW)

25449 (DOE/ER/10961—1-Pt.A, pp 11-26) **Solar pond power plant project at the Dead Sea.** Bronicki, L.Y. (ORMAT Turbines Ltd., Yavne, Israel). 1982. The Weizmann Science Press of Israel, P.O. Box 801, Jerusalem 91007 Israel. File Number TI83015664. (CONF-8208106—Pt.A).

From 4. international conference on photochemical conversion and storage of solar energy; Jerusalem, Israel (8 Aug 1982).

The project to develop a 5 MW power plant utilizing a solar pond and a low-temperature organic vapor turbogenerator is described. Preliminary work leading to the project is reviewed and the project baseline design is discussed.

25450 (DOE/ER/10961—1-Pt.A, pp 27-42) **Steam generators competing with oil.** Goldman, A.J. (Luz International Ltd., Jerusalem, Israel). 1982. The Weizmann Science Press of Israel, P.O. Box 801, Jerusalem 91007 Israel. File Number TI83015664. (CONF-8208106—Pt.A).

From 4. international conference on photochemical conversion and storage of solar energy; Jerusalem, Israel (8 Aug 1982).

Experience in the formation of a competitive solar heat company is reviewed. A description of the marketing strategy for an industrial process heating system utilizing distributed solar collectors is presented.

25451 (EPRI-AP—3982) Studies on water-steam Rankine-cycle solar central receiver power plants. Final report. Darnell, J.R.; Lessley, R.L.; Paffenbarger, J.A.; Agur, A.A. (Bechtel Group, Inc., San Francisco, CA (USA)). Apr 1985. 193p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920609.

Cost estimates are provided for four 150 MWe solar hybrid central receiver power plants, based on the updating of conceptual designs developed in a previous EPRI solar hybrid power plant cost study, Water/Steam Rankine Cycle Solar Central Receiver Power Plant Cost Estimates. The power plants are hybrid in that main steam is generated in a central receiver and a conventional fossil-fueled boiler. The power plants employ either an external cylinder solar receiver or cavity solar receiver, each in combination with a wet or dry cooling tower heat rejection scheme, for a total of four variations. Using the results of a thorough review of current literature, experimental evidence, and pilot plant results, the thermal performance of the two types of solar central receivers is estimated. The receiver efficiencies are used to size all solar portions of the plant and re-estimate capital and operating and maintenance costs from the previous study. In addition, the sensitivity of these costs to variations in receiver efficiency is calculated.

25452 (SAND—84-2454) Proceedings of the distributed receiver solar thermal technology conference. Muir, J.F. (ed.). (Sandia National Labs., Albuquerque, NM (USA)). Apr 1985. Contract AC04-76DP00789. 269p. (CONF-850489—Summs.). NTIS, PC A12/MF A01; 1; GPO Dep. File Number DE85010551.

From Distributed receiver solar thermal technology conference; Albuquerque, NM, USA (24 Apr 1985).

The Distributed Receiver Solar Thermal Technology Conference was held on April 24 and 25, 1985 at the Classic Hotel, Albuquerque, New Mexico. The meeting was sponsored by the United States Department of Energy and Sandia National Laboratories. Topics covered during the conference included a status summary of the Sandia Distributed Receiver Development project, perspectives on distributed receiver electric technology and distributed receiver energy collection and conversion, technologies, systems analyses and applications experiments. The proceedings contain summaries (abstracts plus principal visual aids) of the presentations made at the conference.

1408 Ocean Energy Systems

REFER ALSO TO CITATION(S) 26022

1409 Solar Thermal Utilization

REFER ALSO TO CITATION(S) 25446, 25485, 25719

25453 (BNL—36191) Comparative evaluation of ground-coupled heat pumps that use solar energy. Andrews, J.W.; Catan, M.A. (Brookhaven National Lab., Upton, NY (USA)). Mar 1985. Contract AC02-76CH00016. 27p. (CONF-8505132—1). NTIS, PC A03/MF A01; GPO Dep. File Number DE85010950.

From 2. workshop on solar assisted heat pumps with ground coupled storage; Vienna, Austria (8 May 1985).

A study of combined building space conditioning systems using both solar energy and heat pumps was conducted for the US Department of Energy (DOE). Several of these systems used the ground as a source or storage element for thermal energy, in order to reduce or eliminate the need for backup energy. This paper summarizes the results obtained for these systems in the United States, and describes the relationship of ground-coupling to the overall US solar-assisted heat-pump program.

25454 (DFI-TR—109080) Low power, frost resistant, inexpensive solar hot water heater. Loth, J.L. (Dynamic Flow, Inc., Morgantown, WV (USA)). Sep 1980. Contract FG43-79R306121. 41p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85010010.

The object of the work reported was to maximize the thermal capacity of a solar collector and to use city water pressure to force the hot water from the collector to the inlet of the regular domestic hot water heater when water was being used in the house. The frost resistance feature was to be obtained by using an air-filled plastic tube inside the collector water passages so that when freezing the ice expansion would collapse the plastic tube rather than bursting the copper lines. The frost resistance feature was extensively tested during the winter of 1979-1980. Repeated thawing and freezing and thawing showed that the presence of the air-filled plastic tube delayed but did not prevent bursting. Thermal storage is effected by a mixture of cement and anthracite surrounding the copper water pipe. This proved too heavy and the performance was too dependent upon hot water use. A preheater and circulating pump were added. (LEW)

25455 (DOE/CE/30749—T2) Site handbook: data acquisition system information Two Rivers School, Fairbanks North Star Borough, Alaska. Passive Solar Commercial Buildings Program. (Architectural Energy Corp., Westminster, CO (USA)). Jan 1985. Contract AC02-82CE30749. 23p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010913.

The Two Rivers School consists of seven solar modules, one of which, the one that was monitored, contained thermal shutters that were operated in three modes: an open mode for direct gain, a half open mode for diffuse daylighting without solar gain, and a closed insulating mode. The components of the data acquisition and monitoring system, their location, output, and a description of the installation procedures are given. (LEW)

25456 (DOE/R0/00470—T1) Demonstration Trombe Wall for space heating shared community-oriented facility Faith Lutheran Evangelical Church-Treasure Valley Christian Co-op. Bauman, M. (Faith Lutheran Evangelical Church, Caldwell, ID (USA)). 1981. Contract FG06-80R000470. 3p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010221.

25457 (DOE/R0/00510—T1) Northwest solar home book. Fugate, S.; Raabe, J. (Fugate (Sandra), Seattle, WA (USA)). [1985]. Contract FG06-80R000510. 129p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE85007805.

Wind power is one of the subjects briefly discussed. The main topic of the book is solar energy, or more specifically passive solar energy systems. Several house plans and designs are presented to show the various configurations of passive solar homes. Greenhouses, Trombe walls, and direct gain are just a few of the passive heating systems mentioned. Solar water heating systems are also included. Energy conservation methods are discussed. (BCS)

25458 (DOE/R0/01324—T1) Gardening under cover: a northwest horticultural guide to solar greenhouses, coldframes and cloches. Head, W. (Amity Foundation, Eugene, OR (USA)). [1985]. Contract FG06-81R001324. 77p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85010220.

Gardening in a solar greenhouse, coldframe, or cloche, which is a simple protective covering placed over a garden bed, is discussed, including the construction of two different types of cloche, identification of herbs and flowers, suitable for a solar greenhouse, forcing spring bulbs, and pests and diseases commonly found on plants growing in cold frames and greenhouses. (LEW)

25459 (DOE/R3/02405—T1) SHOWCASE Project (Solar Heated Old Wall Collecting and Storing Energy). Final report. Hanson, J. (Hanson (John), Jefferson, MD (USA)). 30 Mar 1982. Contract FG43-80R302405. 13p. NTIS, PC A02. File Number DE85009179.

The purpose of the project is to show: that a solar heating system can be applied to an historic structure without harming the

structure's historic appearance or historic fabrics; that with the use of insulation and air channels, an existing south facing masonry wall can be used for isolated heat storage in order to increase the total heat load carried to 80%; that the use of a quadruple glazing system utilizing a new long life polyester film significantly increases heat retention with favorable life cycle costs; and that the use of a metal framework in this high heat collector greatly lengthens the life of the system over a conventional wood framework.

25460 **(DOE/R3/02415—T1) Window box collectors for Squirrel Hill.** Halpern, B.J. (Halpern (Bennett J.), Pittsburgh, PA (USA)). May 1981. Contract FG43-80R302415. 46p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85009184.

A prototype thermosyphoning collector was built and installed in the windows of a house in Pittsburgh. Testing of the collectors revealed an efficiency of 35% and a payback period of 10 years. The prototype was redesigned and tested under a DOE grant. The final design of the collector is presented, but only a small amount of data was taken to begin the evaluation of the units. The use of thermal shutters is also included. (BCS)

25461 **(DOE/R3/02422—T1) Demonstration of domestic hot water with combination of wood stove hot water (winter) and homemade solar collector (summer). Final project report.** Nichols, N.S. II. (Nichols (N. Shannon II), Meshoppen, PA (USA)). 3 Sep 1981. Contract FG43-80R302422. 19p. NTIS, PC A03. File Number DE85009186.

The purpose of this project was to demonstrate that adequate hot water can be provided for a family of four in northeastern Pennsylvania, by using a combination of wood stove hot water in the winter and solar collector hot water during the non-heating months. This demonstration would be to encourage other people in the area to investigate using similar energy-saving systems, by providing an observable operating installation, and by increasing their confidence in using simple alternate-energy sources.

25462 **(DOE/R3/02423—T1) Retrofitting a single family dwelling with a passive solar supplementary heating system. Draft final report.** Corra, J.P. (Corra (John P.), Yardley, PA (USA)). 30 Sep 1981. Contract FG43-80R302423. 6p. NTIS, PC A02. File Number DE85009514.

A single family dwelling has been successfully retrofitted with a passive solar supplementary heating system. This system, in the form of a Trombe Wall, was attached directly to the South facing masonary wall of the dwelling. It was rather easily constructed using locally available materials, and no major problems have been encountered during its five months of operation. Preliminary indications are that the wall will indeed help reduce consumption of home heating oil, because of the fact that the two bedrooms adjacent to the Trombe Wall feel noticeably warmer than the remainder of the dwelling.

25463 **(DOE/R3/02439—T1) Insulated Trombe Wall development and testing. Final report.** Frech, G.M. (Frech (Gregory M.), Virginia Beach, VA (USA)). Sep 1982. Contract FG43-80R302439. 42p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85008996.

The research reported here was generated by the idea that a solid mass Trombe Wall is uncomfortably cool in the evening hours for the occupants. Two test cubicles were constructed to research the possible advantage of an insulated version of the vented Trombe Wall. Various experiments were conducted with the two cubicles to make this comparison. The experiments conducted in this research show that the heat loss protection afforded by the solid mass Trombe Wall was totally dissipated by the time of sunrise, and that interior temperatures would be better protected if the Trombe Wall contains a permanent layer of insulation within its mass.

25464 **(DOE/R3/06099—T1) Passive solar pit greenhouse. Final report, September 30, 1979-September 30, 1980.** Freeman, L.H.; Freeman, R.S. (Freeman (Lisa H.), Malvern, PA (USA); Freeman (Robert S.), Malvern, PA (USA)). 20 Aug 1980. Contract FG43-79R306099. 14p. NTIS, PC A02. File Number DE85008252.

This 37 by 10-foot pit greenhouse was designed and constructed for the purpose of demonstrating passive solar energy. The progression of construction and financial budget report of the project are included. (BCS)

25465 **(DOE/R3/06118—T1) Passive solar greenhouse, Ona Junior High School, Ona, West Virginia. Final report.** Murray, M.L.; Murwin, S.W. (Ona Junior High School, WV (USA)). Feb 1981. Contract FG43-79R306118. 19p. NTIS MF A01; 2; GPO Dep. File Number DE85010169.

The project not only served as an introduction to energy awareness, but also allowed students to develop skills in contemporary construction techniques. The constructed greenhouse attempted to capture as much solar energy as possible by proper siting and design features. Heat losses from inside the structure were minimized through the use of extra insulation, double glazing, caulking and insulated shutters. A thermal mass storage system utilized rocks and water containers to store excess daytime heat and reradiate it at night.

25466 **(DOE/R3/08094—T1) Peace Valley Nature Center: solar expansion. Final technical report.** (Bucks County Dept. of Parks and Recreation, Langhorne, PA (USA)). 8 Apr 1983. Contract FG43-81R308094. 55p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85010170.

An addition to an existing building at the Peace Valley Nature Center to provide exhibit space, an assembly room and a greenhouse for use in nature demonstrations was constructed. The work consisted of the construction of insulated footings, drainage of footings, insulation and construction of rock heat storage area beneath the building floor, building of the superstructure and installation of glazing around greenhouse, installation of Clivus multrum composting toilet and a wood stove for auxiliary heating. This project will expand and retrofit the existing building to make it a demonstration for solar energy use, wood heating, alternative sewage disposal and food production through innovative and intensive gardening techniques. After construction is completed the area will be used for energy education programs.

25467 **(DOE/R3/08100—T1) Germanna Community College student government solar energy conservation project. Final technical report.** Tate, J.C. (Germanna Community Coll., Locust Grove, VA (USA)). 1982. Contract FG43-81R308100. 33p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85010172.

Plans for this project provided for the construction of window-unit heat grabbers and attached greenhouse system on the south-facing wall of Germanna Community College. These solar units were designed to reduce the consumption of natural gas in the present heating system and to test the feasibility of applying appropriate solar technology to a building that was designed and constructed before the use of renewable energy resources had received national attention.

25468 **(EPRI-EM—4013) Thermal performance and economic benefits of residential passive solar systems.** Neal, R.W.; Wood, R.A.; McCabe, T.F. (JBF Scientific Corp., Winchester, MA (USA)). Apr 1985. 135p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920583.

In earlier phases of the project a computer methodology was developed for electric utilities to use in analyzing the advantages and disadvantages, for themselves and their customers, of passive solar residential construction in their service areas. The specific objectives of Phase III were: to use the computer methodology to evaluate load management options not considered in Phases I and II of the project: ground-coupled heat pumps; a variety of passive solar building elements (infrared-reflecting window film, triple-pane windows, selective surfaces for mass walls, and highly reflective exterior surfaces); and multi-family passive solar units; and to compare building performance simulation results derived from the EMPS-2 computer program - the first of the four computer programs composing this methodology - with experimental data obtained in an existing full-scale passive solar demonstration project. Ground-coupled heat pumps were shown to be most cost-effective

in northerly climates where heating loads dominate. They may also be economically viable in hot, cooling-load dominated climates if well drilling costs are reasonable. Analysis of infrared-reflecting window films, triple-pane windows, and selective surfaces for mass walls indicated that all are economically justifiable if considered on a life-cycle cost basis. Highly reflective exterior surfaces were found to be uneconomical. Evaluation of multifamily condominium units showed negligible differences in energy performance between the existing passive solar design and a simulated energy-conserving design using heavier insulation, smaller amounts of south-facing glass, electric resistance heat, and vapor air conditioning. EMPS-2 simulation results proved accurate and useful in all cases investigated.

25469 **(LA-UR—85-728) Gap between active and passive solar heating.** Balcomb, J.D. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 8p. (CONF-850604—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85007685.

From INTERSOL '85 - Solar energy--the diverse solution; Montreal, Canada (23 Jun 1985).

The gap between active and passive solar could hardly be wider. The reasons for this are discussed and advantages to narrowing the gap are analyzed. Ten years of experience in both active and passive systems are reviewed, including costs, frequent problems, performance prediction, performance modeling, monitoring, and cooling concerns. Trends are analyzed, both for solar space heating and for service water heating. A tendency for the active and passive technologies to be converging is observed. Several recommendations for narrowing the gap are presented.

25470 **(LA-UR—85-868) DHC: a diurnal heat capacity program for microcomputers.** Balcomb, J.D. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 8p. (CONF-850241—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85009545.

From 1. national conference on microcomputer applications for conservation and renewable energy; Tucson, AZ, USA (26 Feb 1985).

A computer program has been developed that can predict the temperature swing in direct gain passive solar buildings. The diurnal heat capacity (DHC) program calculates the DHC for any combination of homogeneous or layered surfaces using closed-form harmonic solutions to the heat diffusion equation. The theory is described, a Basic program listing is provided, and an example solution printout is given.

25471 **(LA-UR—85-869) Impacts of research efforts on new and existing buildings.** Neeper, D.A. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 7p. (CONF-850388—5). NTIS, PC A02/MF A01; GPO Dep. File Number DE85009546.

From Solar buildings: realities for today - trends for tomorrow; Washington, DC, USA (18 Mar 1985).

This paper reviews some of the resources for natural heating and cooling of buildings and outlines the potential benefits of specific examples of advanced research. The needs and possibilities for superior glazings, switchable glazings, thermal diodes, thermal transport systems, phase-change material in wallboard, and low-emissivity wall coatings are examined.

25472 **(LA-UR—85-1045) Natural air motion in passive buildings.** Balcomb, J.D.; Jones, G.F. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 7p. (CONF-850388—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85009623.

From Solar buildings: realities for today - trends for tomorrow; Washington, DC, USA (18 Mar 1985).

The nature of natural convection is described, and a design chart is presented appropriate to a simple, single-doorway situation. Natural convective loops that can occur in buildings are described and a few experimental results are presented. Observations of stratification are discussed, similitude experiments are described, and the beginnings of a complete-system mathematical model are presented.

25473 (MRI/SOL—1101, pp 389-394) **Solar energy activities in Jordan.** Kabariti, M.A. (Royal Scientific Society, Amman, Jordan). 1982. NTIS, PC A19/MF A01. File Number DE84015232. (CONF-820312—; SERI/CP—270-1521).

From Solar storage workshop; Jeddah, Saudi Arabia (21 Mar 1982).

Jordan is a developing country that is totally dependent on oil imports for all its energy needs. Jordan is blessed with a good solar energy resource. The average daily radiation is about 5 kWh/m^2 and the sunshine duration is about 3000 hr/year. This document presents in brief the activities and capabilities of the Royal Scientific Society (RSS) in the field of solar and wind energy. Solar energy applications at present are given in the last section.

25474 (MRI/SOL—1101, pp 427-428) **Solar energy storage: general survey and evaluation.** Zahr, K.M. (Ministry of Planning, Riyadh, Saudi Arabia). 1982. NTIS, PC A19/MF A01. File Number DE84015232. (CONF-820312—; SERI/CP—270-1521).

From Solar storage workshop; Jeddah, Saudi Arabia (21 Mar 1982).

Solar energy is an abundant resource in Saudi Arabia; high levels of solar insolation and low cloud covers give a Saudi-based solar technology a comparative advantage. Priorities, however, are determined by national needs for limited or scarce resources. Thus, in addition to the solar-based development presently being undertaken and because of the large component of energy demand for air-conditioning, a Kingdom-based effort toward developing an economical thermochemical heat pump for cooling and heating applications is worthy of consideration. Another worthy endeavor is the development of a viable solar-based desalination technology. In this respect a dual purpose, water desalination-power generation solar central station is worth investigating. Possible sites for such a project may exist along the Arabian Shield at the Western Coast where a pumped storage subsystem could be integrated into the project.

25475 (MRI/SOL—1101, pp 359-366) **Use of water-bentonite mixtures as a material for Trombe walls.** Alanis, E.; Rovetta, L.; Saravia, L. (Universidad Nacional de Salta, Argentina). 1982. NTIS, PC A19/MF A01. File Number DE84015232. (CONF-820312—; SERI/CP—270-1521).

From Solar storage workshop; Jeddah, Saudi Arabia (21 Mar 1982).

In the present paper the behavior of a mixture of water and bentonite (W-B mixture) as a filling material for containers used in water wall type collectors is discussed. The W-B mixture shows a rheological behavior similar to that of a Bingham plastic, stopping the convective motions present in water walls. In this way a Trombe wall type collector is obtained with thermal properties very similar to those of concrete walls while its weight is five times smaller. In order to study the stability of the mixture when a thermal gradient is present, a 1.2 m x 0.5 m x 0.1 m (4 ft x 1.6 ft x 0.3 ft) experimental model wall was built. No convection currents were observed for the temperature values usual in Trombe walls proving that the mixture behaves like a solid, as expected for low shear stresses in a Bingham plastic. The thermal lag in the W-B mix as well as in concrete were calculated; the values obtained are very similar. This aspect was confirmed through computational models used in the simulation of Trombe wall collector made of different materials.

25476 (MRI/SOL—1101, pp 263-274) **Thermal energy storage systems for solar powered desalination plants.** Mujahid, A.M. (King Saud Univ., Riyadh, Saudi Arabia). 1982. NTIS, PC A19/MF A01. File Number DE84015232. (CONF-820312—; SERI/CP—270-1521).

From Solar storage workshop; Jeddah, Saudi Arabia (21 Mar 1982).

Modification of conventional desalination plants to operate on solar energy necessitates the use of energy storage to supply the plant with the needed energy in bad weather and at night. Heat can be stored by change of phase (latent heat) or chemical reaction; however, here the technology is not sufficiently well developed. On the other hand, sensible heat storage is advanced enough for

near term application. This paper discusses three different sensible heat storage systems which can be used for solar powered desalination plants. These include energy storage by means of fluidizable solids, energy storage in aquifers, and a two-stage thermal storage system. All of these are sensible heat storage systems.

25477 **(NP—5770200) Demonstration house heated by solar energy.** (Fachhochschule Luebeck (Germany, F.R.)). 1983. 79p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE85770200.

In February 1978 Luebeck Polytechnic developed the concept of a solar house as an object for research and demonstration. Its purpose was to acquire knowledge about the active and passive utilisation of solar energy with consideration of special planning and design criteria. The aim was to prove that even in Schleswig-Holstein it is possible to meet the heating energy requirements of a house for a single family by radiated and environmental energy. First of all the planning and architectural principles of the house are described. Then the solar concept for the house is dealt with and the first data on the properties of the solar heating and hot water system backed up by heat pumps. One article deals with the opportunities offered and limitations on the utilisation of solar energy in Central Europe.

25478 **(PB—85-160752/XAB) Potash recovery from process and waste brines by solar evaporation and flotation. Report of Investigations/1984.** Foot, D.G.; Huiatt, J.L.; Froisland, L.J. (Bureau of Mines, Salt Lake City, UT (USA). Salt Lake City Research Center). 1984. 34p. (BM-IC—8911). NTIS, PC A03/MF A01.

The Bureau of Mines investigated energy-efficient methods for recovering potash values from process and waste brines. Laboratory pan evaporation of four chloride brines produced crude salts containing predominantly sylvite, halite, and carnallite. Six sulfate-chloride brines produced crude salts containing primarily schoenite, kainite, leonite, sylvite, carnallite, and halite. An economic evaluation suggested a rate of return of 3 pct for a new facility and 9 pct if the process is adapted to fit an existing plant.

25479 **(SERI/TP—253-2681) Component reliability and control system testing.** Farrington, R.B. (Solar Energy Research Inst., Golden, CO (USA)). Mar 1985. Contract AC02-83CH10093. 9p. (CONF-850388—7). NTIS, PC A02/MF A01; GPO Dep. File Number DE85008792.

From Solar buildings: realities for today - trends for tomorrow; Washington, DC, USA (18 Mar 1985).

The Solar Energy Research Institute has been involved in testing active components reliability and control systems. Six test loops were constructed to thermally cycle drain valves, check valves, air vents, vacuum breakers, tempering valves, and polybutylene piping. Results showing poor reliability of some of the components and limited performance of others lead to a better understanding of certain failures in the field and present designers with realistic expectations for these components. The seven SDHW control systems tested included thermistors switches, RTDs, IC sensors, and controllers. Serious reliability problems included sensor degradation or failure from high temperatures, and controllers that did not meet specifications. As much as 50% of collected energy can be lost because of sensor degradation, and auxiliary energy requirements can increase by 250%.

25480 **(SERI/TR—255-1828) Materials research for passive solar systems: solid-state phase-change materials.** Benson, D.K.; Webb, J.D.; Burrows, R.W.; McFadden, J.D.O.; Christensen, C. (Solar Energy Research Inst., Golden, CO (USA)). Mar 1985. Contract AC02-83CH10093. 56p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85008779.

A set of solid-state phase-change materials is being evaluated for possible use in passive solar thermal energy storage systems. The most promising materials are organic solid solutions of pentaerythritol ($C_5H_{12}O_4$), pentaglycerinve ($C_5H_{12}O_3$), and neopentyl glycol ($C_5H_{12}O_2$). Solid solution mixtures of these compounds can be tailored so that they exhibit solid-to-solid phase transformations at any desired temperature betweeen 25°C and 188°C, and have latent heats of transformation between 20 and 70 cal/g. Transformation temperatures, specific heats, and latent heats of transformation have been measured for a number of these materials. Limited cyclic experiments suggest that the solid solutions are stable. These phase-change materials exhibit large amounts of undercooling; however, the addition of certain nucleating agents as particulate dispersions in the solid phase-change material greatly reduces this effect. Computer simulations suggest that the use of an optimized solid-state phase-change material in a Trombe wall could provide better performance than a concrete Trombe wall four times thicker and nine times heavier. Nevertheless, a higher cost of the phase-change materials (≃$0.70 per pound) is likely to limit their applicability in passive solar systems unless their performance can be significantly improved through further research.

25481 **SERI research investigates core daylighting.** *SERI in Review;* 6: No. 10, 1-4(Nov 1984).

SERI's Thermal Systems and Engineering Branch investigated the direct use of heliostats for illuminating the interiors of nonresidential buildings. Although it is still in the early, experimental stage, this project is one of a variety of advanced core daylighting concepts being tested, including selective glazing materials, direct-beam daylighting, optical fibers, and light pipes.

1410 Solar Collectors And Concentrators

REFER ALSO TO CITATION(S) 25486

25482 (DOE/ER/10961—1-Pt.A, pp 43-62) **Luminescent solar concentrators.** Berman, E.; Wildes, P. (ARCO Solar, Inc., Chatsworth, CA). 1982. The Weizmann Science Press of Israel, P.O. Box 801, Jerusalem 91007 Israel. File Number TI83015664. (CONF-8208106—Pt.A).

From 4. international conference on photochemical conversion and storage of solar energy; Jerusalem, Israel (8 Aug 1982).

Work on defining the potential for a luminescent concentrator/solar cell system is described. The work has included an evaluation of the economic potential as well as the physical and chemical properties of the luminescent materials. Some of the important properties of luminescent concentrators are that they (1) collect diffuse as well as direct radiation, (2) minimize heat dissipation problems, (3) allow separation of absorber and converter, and (4) allow more efficient use of narrow spectral response converters.

25483 **(DOE/R3/02404—T1) Heliostat boiler solar converter. Final report.** Gerwin, H.L. (Gerwin (Harry L.), Silver Spring, MD (USA)). 8 Mar 1982. Contract FG43-80R302404. 25p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85009177.

Tracking tests to determine heliostat tracking performance and full system tests to measure useful heat conversion capacity of the system were performed on a three heliostat system. The results of this project effort show that the low-cost heliostat system is more cost effective than the flat-panel systems for generating hot water at 140°F for installations in households, apartment buildings, office buildings and dairy farms. The system can supply low pressure steam for industrial operations.

25484 **(LA—10344-SR) Thickness-insensitive selective surface paint. Status report.** Moore, S.W. (Los Alamos National Lab., NM (USA)). Mar 1985. Contract W-7405-ENG-36. 27p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85010568.

Testing and evaluation of passive Trombe/mass wall systems have identified the need for a selective absorber paint that can be applied to concrete, brick, or any storage or absorber surface that does not particularly lend itself to the application of a selective foil. Testing and modeling at Los Alamos have shown the large benefits that can result from the incorporation of selective surfaces into passive systems. The grouting and surface preparation required to prepare a storage wall for application of a selective foil have proven to be a problem area that can be highly labor intensive. Large thermal resistances between a selective foil and the storage mass can also severely degrade the selective absorber benefits. There is a great need for an inexpensive, good performing, paint-type selective coat-

ing that can be easily applied to solar absorber elements, that is, applied by merely spraying it on the rough, unprepared surface.

25485 (MRI/SOL—1101, pp 233-262) **Solar ponds: a seasonal solar energy storage system for process heat application.** Darwish, M.A. (King Abdulaziz Univ., Jeddah, Saudi Arabia). 1982. NTIS, PC A19/MF A01. File Number DE84015232. (CONF-820312—; SERI/CP—270-1521).

From Solar storage workshop; Jeddah, Saudi Arabia (21 Mar 1982).

A solar pond is a large body of water solution containing (1) a thin surface convective layer of fresh or low salinity water, (2) a stable nonconvective transparent zone in which density, salinity, and temperature gradients exist, and (3) a convective (or storage) bottom layer of high salinity water. The salinity and density increase downward in the gradient zone. The gradient zone is transparent to solar energy, which is absorbed in the storage zone, while it acts as an insulator to heat conduction from the storage zone, thus acting as a heat trap. The energy that reaches the storage zone is stored there (as sensible heat) and can be extracted as useful heat. So, the solar ponds is a solar collector-storage system. This paper outlines the static and dynamic stability criteria of the gradient zone, the establishment and preservation of the salinity gradient, and thermal analysis of the pond. A solar pond operated humidification-dehumidification desalination system is suggested. Also, other applications are given.

1420 Heat Storage

REFER ALSO TO CITATION(S) 25474, 25475, 25480, 25485, 25659, 25719

25486 (MRI/SOL—1101, pp 417-426) **Techno-economic analysis of solar energy collector-storage systems.** Saif-ul-Rehman, M. (Pakistan Council of Scientific and Industrial Research, Lahore). 1982. NTIS, PC A19/MF A01. File Number DE84015232. (CONF-820312—; SERI/CP—270-1521).

From Solar storage workshop; Jeddah, Saudi Arabia (21 Mar 1982).

In the light of the present increasing energy needs, increasing oil prices, and decreasing fossil energy sources, the potential of solar energy as a renewable energy source, in all sunny countries of the world, is self-evident. In this paper the different aspects of solar energy storage systems are discussed with a view to analyse the technoeconomics of solar energy utilization for practical purposes in competition with other available alternatives.

25487 (MRI/SOL—1101, pp 375-388) **Free boundary value problems and the phase-change energy storage systems.** Hackenberg, C.M. (COPPE/Universidade Federal do Rio de Janeiro, Brazil). 1982. NTIS, PC A19/MF A01. File Number DE84015232. (CONF-820312—; SERI/CP—270-1521).

From Solar storage workshop; Jeddah, Saudi Arabia (21 Mar 1982).

This paper presents some of the most important results obtained in the Thermo-Fluid-Dynamics Laboratory at COPPE/Universidade Federal do Rio de Janeiro for the storage of energy at high temperatures. The analytical and experimental results achieved on the determination of the melting front kinematic parameter are highly significant and show that the position of the melting front may be predicted from the analysis of a free boundary value problem of Stefan type. This diffusive model and the heat flux jump condition are sufficient to determine the temperature profiles for both liquid and solid phases when melting occurs ina solid block due to the presence of high temperatures on its surfaces. A simple conductive, unidirectional model and a radial cylindrical coordinate system is analyzed to explain the fusion front dynamic behavior. The results are then applied to determine the efficiency of thermal energy storage by phase-change of tin and paraffin wax. Furthermore, it is also shown that the kinematic melting parameter may be predicted for the maximal thermal storage efficiency as a function of the applied temperature potential.

15 GEOTHERMAL ENERGY

1502 Geology And Hydrology Of Geothermal Systems

REFER ALSO TO CITATION(S) 25497, 25498

1503 Geothermal Exploration And Exploration Technology

25488 (EUR—8299/XAB) **Distribution of electrical conductivity in the crust/upper mantle in the geothermal anomaly area of Tuscany.** Haak, J.; Schwarz, G. (Commission of the European Communities, Luxembourg). [1985]. 113p. (In German). (EUR—8299-DE). NTIS, PC E05/MF E01.

Magnetotelluric and geomagnetic depthsoundings were carried out in the area of the strongest geothermal anomaly in continental Europe - the western part of Tuscany - in the years 1978 and 1979 to study the distribution of electrical conductivity in the crust and upper mantle. During the same time the crustal structure of Tuscany was under study by seismic-refraction measurements from a German-Italian Research Group. The aim of these projects was to develop a geothermal model of Tuscany.

25489 (EUR—9333/XAB) **Active audiomagnetotellurics, a method for the determination of the conductivity of the crustal structure-with model calculations and applications to the geothermal anomaly of travale-radicondoli (Tuscany).** Otten, J. (Commission of the European Communities, Luxembourg). [1985]. 150p. (In German). (EUR—9333-DE). NTIS, PC E06/MF E01.

The report deals with theory and practice of active audiomagnetotellurics. The following points are described: - a new field unit - model calculations for the magnetic fields - results and interpretation. The measuring unit consists of a receiving station and a transmitter at a distance of 2-10 km. Here 10-amp. a-c current with a frequency of between 0.01 and 2500 Hz is fed into the earth through a 300-m-long dipole. The receiving unit registers the artificially-induced electromagnetic fields. The value and phase of electrical field-strength as well as the magnetic field density are measured, from which the specific resistance and its plans are calculated. The model calculations deal with the electric and magnetic field of an electrical dipole over a half-space with three layers. They are based on the theory of Sommerfield, that is transformed into relations that allow numerical calculation. The models were used for the interpretation of the measured data that were collected in the geothermal area of Travale-Radicondoli (Tuscany). The measurements were in agreement with the theory and with the findings of other authors.

25490 (LBL—18146) **Fracture detection and mapping for geothermal reservoir definition: an assessment of current technology, research, and research needs.** Goldstein, N.E. (Lawrence Berkeley Lab., CA (USA)). Nov 1984. Contract AC03-76SF00098. 65p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85010627.

The detection and mapping of fractures and other zones of high permeability, whether natural or manmade, has been a subject of considerable economic and scientific interest to the pertroleum industry and to the geothermal community. Research related to fractured geothermal reservoirs has been conducted under several past DOE geothermal energy development programs. In this paper we review the present state of technology in fracture detection and mapping. We outline the major problems and limitations of the "conventional" techniques, and current research in new technologies. We also present research needs.

25491 (USGS-OFR—82-111) **Gravity survey of Dixie Valley, west-central Nevada.** Schaefer, D.H. (Geological Survey, Carson City, NV (USA)). 1983. 50p. US Geological Survey, Box 25425, Denver Federal Center, Denver, CO 80225. File Number TI85901345.

Dixie Valley, a northeast-trending structural trough typical of valleys in the Basin and Range Province, is filled with a maxi-

mum of about 10,000 feet of alluvial and lacustrine deposits, as estimated from residual-gravity measurements obtained in this study. On the basis of gravity measurements at 300 stations on nine east-west profiles, the gravity residuals reach a maximum of 30 milliGals near the south-central part of the valley. Results from a three-dimensional inversion model indicate that the central depression of the valley is offset to the west of the geographic axis. This offset is probably due to major faulting along the west side of the valley adjacent to the Stillwater Range. Comparison of depths to bedrock obtained during this study and depths obtained from a previous seismic-refraction study indicates a reasonably good correlation. A heterogeneous distribution of densities within the valley-fill deposits would account for differing depths determined by the two methods. 17 refs., 4 figs., 2 tabs.

1506 Environmental Aspects And Waste Disposal

REFER ALSO TO CITATION(S) 25174, 26217

25492 **(CONF-850207—7) Louisiana Gulf Coast seismicity induced by geopressured-geothermal well development.** Stevenson, D. (Louisiana Geological Survey, Baton Rouge (USA)). 1985. Contract AC08-81NV10174. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010426.

From Geopressured-geothermal energy conference; Austin, TX, USA (4 Feb 1985).

Continuous microseismic monitoring networks have been established around three US Department of Energy geopressured-geothermal design wells in southwestern Louisiana since summer 1980 to assess the effects well development may have on subsidence and growth fault activation. The results obtained from this monitoring have shown several unusual characteristics associated with Gulf Coast seismic activity. The observed activity is classified into two dominant types, one with identifiable body phases and the other with only surface wave signatures. The latter type comprises over 99% of the reported 1000+ microseismic event locations. The problem with the slow-moving surface-wave signature events is that rainfall and weather-associated frontal passages seem closely related to these periods of seismic activity at all three wells. After relatively short periods and low levels of flow testing at the Parcperdue and Sweet Lake prospects, seismic monitoring has shown little credible correlation to inferred growth fault locations during periods of flow testing. Longer periods and higher volumes of flow testing at the Rockefeller Refuge prospect should provide a truer indication of induced seismicity attributable to geopressured-geothermal development. 4 refs., 5 figs.

25493 **(EGG-PBS—6818) Hydrothermal Injection Program: Raft River (KGRA) Idaho, 1982 test data index.** Freiburger, R.M.; Hull, L.C.; Clemo, T.M. (EG and G Idaho, Inc., Idaho Falls (USA)). Apr 1985. Contract AC07-76ID01570. 61p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85010132.

Presented is an index for the Hydrothermal Injection Program test data collected over a three-month testing and monitoring period, starting September 1, 1982 at the Raft River Geothermal Site located in Southern Idaho. The test program consisted of injecting tracer solutions into a geothermal well, and the withdrawing the fluid from the same well, either immediately, or after a quiescent period. These data, stored on tape at the National Technical Information Service (NTIS), US Department of Commerce, Springfield, Virginia, consist of concentrations of injected tracer solutions, natural water chemistry, wellhead temperature, pressure and flow, downhole temperature and conductivity, caliper and spinner data along with wellhead pressure responses of the monitoring wells. The stored data have been screened to ensure that they are reasonable and internally consistent.

1509 Geothermal Engineering

REFER ALSO TO CITATION(S) 25226

25494 **(DOE/AL/18536—T1) Investigation of component failures in downhole geothermal pumping systems. Final report.** Werner, D.K. (Barber-Nichols Engineering Co., Arvada, CO (USA)). 15 Mar 1985. Contract AC04-82AL18536. 48p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85009648.

This study investigated component failures in electric, downhole submersible pumps which prevented the attainment of one year continuous downhole running times in geothermal wells at temperatures up to 375°F. The feasibility of a pressurized motor to prevent brine intrusion was investigated, as well as improved pothead and packoff designs, and brine scale buildup on impeller sleeve bearings and thrust washers. (ACR)

25495 **(SAND—85-0783C) Lost circulation in geothermal wells: research and development status.** Caskey, B.C.; Satrape, J.V. (Sandia National Labs., Albuquerque, NM (USA); Meridian Corp., Falls Church, VA (USA)). 1985. Contract AC04-76DP00789. 6p. (CONF-850801—30). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85009836.

From International symposium on geothermal energy; Kailua Kona, HI, USA (26 Aug 1985).

The most common severe problems encountered in drilling and completing geothermal wells are lost circulation (loss of fluid returns to the surface), stuck pipe, and inadequate cementing. Lost circulation is the single most costly and troublesome well development problem; it may also cause or aggravate stuck pipe and cementing problems. Sandia National Laboratories is conducting an aggressive research and development program aimed at understanding and solving lost circulation problems. The program is aimed at finding and characterizing loss zones, modeling the dynamics of zone plugging, testing materials and techniques in the laboratory, and developing holistic solutions for combating lost circulation. Significant work has been completed in instrumentation, materials testing, and numerical modeling. Work devising an "expert" system for fluid loss control has begun. 12 refs., 4 figs.

25496 **(SAND—85-0849C) Development of seals for a geothermal downhole intensifier. Progress report.** Captain, K.M.; Harvey, A.C.; Caskey, B.C. (Foster-Miller Associates, Inc., Waltham, MA (USA); Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 7p. (CONF-850801—28). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010124.

From International symposium on geothermal energy; Kailua Kona, HI, USA (26 Aug 1985).

A system using high-velocity fluid jets in conjunction with a rotary diamond bit is currently considered as the best candidate for reducing the cost of drilling geothermal wells. Technical, safety and cost considerations indicate that the required jet supply pressure can best be established by a downhole pressure intensifier. Key intensifier components are the check valve and plunger seals, which must prevent leakage of the high-pressure, high-temperature abrasive fluid (drilling mud). To achieve the required performance, novel ceramic seals are currently being developed. The check valve seal includes a tapered polymeric plug and ceramic stop acting against a ceramic seat. The ceramic plunger seal is a variant of the "stepped-joint" piston ring and is designed to minimize contact pressure and abrasive wear. Initial testing of these seals in the laboratory shows encouraging results; design refinement and further testing is in progress. 2 refs., 6 figs., 3 tabs.

1520 Geothermal Data And Theory

25497 (USGS-OFR—83-433-B) Nevada: basic data for thermal springs and wells as recorded in geotherm. Part B. Bliss, J.D. (Geological Survey, Menlo Park, CA (USA)). Jul 1983. 711p. US Geological Survey, P.O. Box 25425, Denver Federal Center, Denver, CO 80225. File Number TI85901360.

This GEOTHERM sample file contains 1367 records for Nevada. The records contain data on location, sample description, analysis type, collection condition, flow rates, and the chemical and physical properties of the fluid. Stable and radioactive isotope data are occassionally available. (ACR)

25498 (USGS-OFR—83-435) Oregon: basic data for thermal springs and wells as recorded in GEOTHERM. Bliss, J.D. (Geological Survey, Menlo Park, CA (USA)). May 1983. 245p. US Geological Survey, Box 25425, Denver Federal Center, Denver, CO 80225. File Number TI85901379.

This sample file contains 346 records for Oregon. The records contain data on location, sample description, analysis type, collection condition, flow rates, and chemical and physical properties of the fluid. Stable and radioactive isotope data are occasionally available. (ACR)

17 WIND ENERGY

1701 Availability (climatology)

REFER ALSO TO CITATION(S) 26058

25499 (STEV-VIND—84-2) Wind predictions in the layer 50 to 150 m. A progress report. Toernevik, H.; Olsson, E. (Statens Energiverk, Stockholm (Sweden)). Dec 1983. 28p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. File Number DE85750886.

Two years of wind data from the Maglarp tower together with observational data from the synoptic stations in the southern part of Sweden, have been used in order to test linear statistical models for wind predictions on the projections: 1, 2, 3 hours. Marginally improvements compared to persistence forecasts were found. A plausible reason for this negative result, is the lack of good initial anlysis of the meteorological parameters, relevant to the problem (wind, pressure temperature). The idea of estimating the profile parameters in the Monin-Obukhov similarity theory and using them as predictors in a regression model, i.e. a non-linear statistical model, has proven to be unfeasible. The reason for this, is mainly due to the measurement errors in the wind and temperature when sampling for 10- and 2 minutes averages. Development of models for detailed analysis of wind, temperature and pressure has begun. Detailed analysis of these fields (one year of data, every 3rd hour) will be done in the very near future for an area relevant for short range predictions of wind at one site: Naesuden. At the same time, wind forecasts from the Swedish Limited Area Fine Mesh Model (LAM) will be achieved in order to test numerical predictions of wind up to 32 hours of projection. A dynamical model which can be used together with LAM for interpretation of large scale winds down to mesoscale winds by introducing mesoscale forcing, has been developed. This model will be used in future work.(author).

1705 Environmental Aspects

REFER ALSO TO CITATION(S) 25506

25500 (STEV-VIND—84-1) Analysis of sound produced by wind turbines in turbulent flow. Juvet, P.J.D. (Statens Energiverk, Stockholm (Sweden)). 1983. 112p. (FFA-TN—1983-44). NTIS (US Sales Only), PC A06/MF A01. File Number DE85750887.

An analytical method, previously developed for helicopters and propellers, is applied to calculate the far-field sound spectrum produced by the interaction of wind turbines with atmospheric turbulence. Although this method is based on a high frequency approximation, it is also applicable at lower frequencies. A linearized aerofoil response to a two-dimensional gust is used to calculate the unsteady blade loading. The atmospheric turbulence model used accounts empirically for anisotropy and inhomogenity of the earth's boundary layer. A computer program is developed and numerical results are presented. The simple formulation of the method allows fast and inexpensive computation. The calculated sound spectrum presents region of peaks and valleys at low harmonics, due to blade correlation, degenerating in a smooth spectrum at higher frequencies. The smooth part of the spectrum decays at about 8 dB per octave. The wind turbine acoustic directivity is close to that of a dipole.(author).

25501 (STEV-VIND—84-14) Description of two methods for calculation of low frequency wind turbine noise, including applications for the Swedish Prototype WECS Maglarp. Gustavsson, A. (Statens Energiverk, Stockholm (Sweden)). 1983. 55p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85750885.

Two computer programs for wind turbine noise calculations are presented. One of the programs is designed to calculate the noise due to the passage of wind turbine blades through the wake of the tower of a downwind turbine. The other program calculates the noise due to the steady loading of the blades (Gutin noise). As a comparison to the results obtained from these programs, some results from a program that calculates the noise from the unsteady loadings due to atmospheric turbulence are included.

1706 Wind Energy Engineering

REFER ALSO TO CITATION(S) 25407, 25473

25502 (DOE/R3/02407—T1) Wind turbine powered heat generator. Final report. (Medaglia (C.P.), Baltimore, MD (USA)). 15 Sep 1981. Contract FG43-80R302407. 19p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85009180.

The preliminary design was conducted for a wind machine capable of handling the heating loads in an average 2000 square foot home. The wind machine is rated at 4.5 kW in a wind of 18 mph and should be operational in winds of 4 to 18 mph. Model testing preceded the design and indicated the form function of the nozzle to be $y = 0.25x^2$ where y is the locus of the nozzle wall and x is the distance from the throat in inches. The machine has a 20 foot equivalent entrance diameter, a 10:1 constriction ratio and a 2 foot wheel radius.

25503 (DOE/R3/02428—T1) Wind powered domestic water heating. Final report. Montgomery, D.A. (Pennsylvania State Univ., University Park (USA)). 1981. Contract FG43-80R302428. 28p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85009268.

The size and type of wind collector appropriate for residential use were researched. There is a brief discussion concerning the availability of wind machines and heat storage systems. The importance of site selection as well as the legal and environmental aspects of wind power usage are discussed.

25504 (DOE/R3/02438—T1) Vertical axis wind turbine with automatic speed control for home builders. Final report. Loth, J.L.; Fanucci, J.B. (Flow Products, Inc., Morgantown, WV (USA)). Sep 1981. Contract FG43-80R302438. 34p. NTIS MF A01; 2; GPO Dep. File Number DE85009244.

The object of this contract was to design, construct and test the hardware of a simple and reliable vertical axis wind turbine. The result of this program has been the development of a simple vertical axis wind turbine with a 6 meter rotor diameter and three blades, each 3 meters high. Each blade support arm streamline cuff ends in a 0.66 meter long drag type flap which is rotated under the action of centrifugal force when the adjustable design feathering rpm is reached. Each flap is actuated independently of the other two. Under normal conditions anyone of the three drag flaps can

provide sufficient aerodynamic braking to prevent overspeeding and rotor damage. The reliability of this overspeed control system is obtained by having three drag flaps, two of which function as back up. The feathering rpm is made adjustable by varying the air pressure in three automotive pneumatic shock absorbers.

25505 **(STEV-VIND—83-26) Actuator for partial span pitch control wind turbines equipped with a small wind turbine for emergency shut down. Preliminary study.** Wallander, O.; Szymczak, S.; Lavenius, N. (Statens Energiverk, Stockholm (Sweden)). Mar 1983. 35p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85750888.

Design loads for pitch control of 30 % of the span in two typical wind turbines are roughly calculated in order to find main layout and dimensions for an actuator located adjacent to the intersection between fixed blade and turnable blade tip and consisting of an electric servomotor, gearbox and screwjack. For emergency situations the screwjack can be powered by a small wind turbine, integrated with the normal actuator for safe shut down of the wind turbine in case of failure in the normal powerfeed to the actuator.(author).

25506 **(STEV-VIND—83-27) Off-shore wind power AIB. 1 Progress report.** Werner, R. (Statens Energiverk, Stockholm (Sweden)). 1983. 17p. (In Swedish). NTIS (US Sales Only), PC A02/MF A01. File Number DE85750893.

In this report the basic features in localization, design a.o., concerning the planning of off-shore wind power plants in the Baltic sea are briefly outlined. A suggested site 4 km off-shore southern Oeland (a Baltic island) is discussed.

25507 **(STEV-VIND—83-34) Influence from variations in wind directions on horizontal axis wind turbines.** Ganander, H.; Olsson, B. (Statens Energiverk, Stockholm (Sweden)). Sep 1983. 61p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. File Number DE85750889.

As the first step in the project a model has been created, to simulate the dynamical behaviour of Hawt. The model includes up to five rigid dof (degrees of freedom). They are: Teeter hinge with delta-3, Yawmotion of nacelle, Turbine rotation, Position of the top of the tower in two horizontal directions. Based on these five dof the dynamical equations has been derived by Lagrangian formulation of the problem. To determine forces and displacements as functions of time the system of differential equations are numerically integrated. The wind is described by velocity, gradient and direction. Both downwind and upwind oriented turbines can be studied, and the hub may be hinged or rigid. To verify the model some simulations of the two Swedish prototypes at Maglarp and Naesudden have been done. For the downwind turbine at Maglarp the yaw and teeter behaviour have been studied. Results from simulations and appropriate measurements have been compared. At Naesudden some special windshear conditions have been studied carefully and compared with recordings. The model and the program predicts the behaviour quite well. To make these predictions even more satisfactory, the elasticity of the blades are planned to be incorporated into the model.(author).

20 ELECTRIC POWER ENGINEERING

25508 **(DOE/R3/02431—T1) Small gasogen operated electrical generator system. Final report.** Malmros, M.K. (Malmros (Mark K.), Washington Crossing, PA (USA)). 1982. Contract FG43-80R302431. 19p. NTIS, PC A02. File Number DE85008985.

A gasogen pyrolysis chamber was constructed and connected with a gasoline-engine electrical generator. A 2000-W, 120-V strip heater was used as a constant load device. The system was operated using coal wood charcoal, or wood chips as fuel. The wood fuel resulted in fouling problems. The engine broke down. (DLC)

2001 Power Plants And Power Generation

REFER ALSO TO CITATION(S) 25198, 25199, 25200, 25211, 25343, 25659, 25835

25509 **(DOE/RA/50231—T3) Briefing summary on conversion of steam plant to coal or coal-derived fuel sources.** Larson, J.W.; Blake, J.C. (Mitre Corp., McLean, VA (USA). METREK Div.). Feb 1981. Contract AC01-80RA50231. 47p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85011267.

The conservation of natural gas and oil resources is a national objective likely to be permanent. Regulatory requirements and economics favor further reduction in the use of these resources for the generation of electricity. Electric utilities reduced their consumption of natural gas and oil over the past few years through use of "economic dispatch." Growth in national demand for electricity declined as new coal- and nuclear-fueled power plants entered operation, creating a substantial excess of reserve margin. Thus, plants fueled by natural gas and oil could be idled as new plants with lower marginal costs of generation picked up the load. This situation may reverse during the late 1980s as the reserve margins decline due to restoration of growth of electricity demand and delays in construction of new plants operating on coal and nuclear energy. The slippages in new plant construction can be partly compensated through conversion of existing oil- and gas-fired power plants to coal. Also, these conversions can have nearer term impact due to the expected speed with which existing plants can be converted, as compared with new plant construction. Therefore, the Division of Direct Combustion Applications in the Department of Energy's Office of Fossil Energy is examining, on a unit-by-unit basis, existing oil- and gas-fired power plants to determine the specific factors that would affect such a conversion. Conversions of this type should only be encouraged where they are reasonable. Financial, economic, regulatory, environmental and technical issues all must be considered before the conclusion may be reached that a fuel conversion is sensible, and all of these factors are addressed in the Department's study. 14 refs., 13 tabs.

25510 **(EPRI-CS—3969) Boiler tube failures at New Boston: a root-cause analysis. Final report.** Land, R.E.; Tome, A.E. Jr.; Adams, R.; Flaherty, P.A.; Johnson, P. (Delian Corp., Monroeville, PA (USA); Boston Edison Co., MA (USA)). Apr 1985. 178p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920611.

In-depth root-cause analysis of equipment problems at power stations is an effective means of maintaining and improving availability. An earlier EPRI study, "Utility-Oriented Approach for Root-Cause Analysis of Power Plant Equipment Problems," proposed a general approach to problem analysis for use by utilities. This report presents the results of a study intended both to test and refine that approach by applying it to an actual power station problem. The problem selected was a recurring tube failure problem at Boston Edison's New Boston Generating Station. Major conclusions of the study are that overheating tube failures at New Boston are the result of several major causes. Primary among these are localized temperature spikes caused by burner-firing patterns and fuel-oil control practices during startup and shutdown, internal fouling in the waterwall-tubes, and flow diversion and flow starvation caused by leaks between feed headers. All of these causes have been aggravated by physical damage done to the boiler walls in the early years of unit operation because operating practices for subcritical, once-through boilers were poorly understood. A list of eight corrective actions to reduce overheating tube failures was generated as a result of the root-cause analysis of the data. 80 figs., 5 tabs.

25511 **(NP—5770212) Life time prediction of gas turbine components (turbine blades).** Hoffelner, W.; Nazmy, M.; Wuethrich, C. (Brown, Boveri und Co. Ltd., Baden (Switzerland)). [1985]. 71p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85770212.

The problems of lifetime predictions for gas turbine blades made of cast alloys IN 738 LC and IN 939 were examined. The materials were tested under typical operating temperatures on their performance under fatigue and creep stress and with combined

strains. The crack formation and crack propagation phases were each studied separately. It was shown that practically no reciprocal effects took place between HCF stress on the one hand and LCF and creep damage on the other. The reciprocal effects of LCF and creep can be described for the cast materials studied by the lifetime models already known. The sub-critical crack propagation can be correlated to the stress intensity factor in the temperature range studied.

25512 **(NP—5770269) FIR- and flue gas tables for the design of gas turbine cycles.** Hartig, E. (Technische Univ., Vienna (Austria). Inst. fuer Dampf- und Gasturbinen). 1984. 50p. (In German). NTIS (US Sales Only), PC A03. File Number DE85770269.

In order to obtain the most accurate thermodynamic design for gas turbines with a minimum of computation, the mathematical operation is divided into individual components without the need to establish specific parameters; these component results are then compiled into tables. Computation is based on standard fuel consisting of 86,08% (mass) of carbon and 13,92% (mass) of hydrogen which at 0 centigrade ought to have a net calorific value of 42.500 KJ/KG. Based on this assumption, the numerous fuel parameters are suppressed, making for greater clarity in the mathematical operation, in case of stoichiometric combustion with dry air, the resulting flue gas has a gas constant equal to that of dry air. Fuel of this composition approximately corresponds to the fuels usually used in gas turbines, with the combustion products mainly consisting of CO_2 and H_2O; these are also comparable in terms of volume to the combustion products of standard fuel. Since the useful effect depends but to a lesser extent on the calorific value and energy action is more thermal-bound, the latter may be more easily adjusted if required. In order to reduce the need for computation to a minimum and in order to assure clarity - particularly for the table printouts - the working medium is assumed to be a semi-ideal gas. Within the pertinent ranges, it is important that air and flue gas properties closely approximate those of a semi-ideal gas.

25513 **(STEV-TORV—83-5) Peat-fired condensing power plants or combined power and heating plants.** Hardell, R. (Statens Energiverk, Stockholm (Sweden)). Jun 1983. 17p. (In Swedish). NTIS (US Sales Only), PC A02/MF A01. File Number DE85750882.

Several possiblities exist for the utilization of the Swedish peat resources, ranging from building large peat-fired condensing power plants to developing small residential boilers, fired with peat pellets. So far, the interest in Sweden has been focused on heating plants that can be fired with different peat products. With regard to the high costs for transportation of the peat fuel, peat resources in the vicinity of densely built areas have been considered to be of primary interest. The possibility to use large peat resources in sparsely populated areas for electricity production in condensing power plants have been studied. The calculations in this report indicate that the cost for power production would be around 0.25 to 0.35 SEK/kWh. These results are partly based on contracts made in Finland in 1980. If peat-fired condensing power plants should be considered further in Sweden, a comparison with coal-fired plants is needed. Cost calculations should also be made for peat-fired combined power and heating plants located far from the peat bogs. In this case, the transportation costs of the peat would be high. Issues of this type have been studied in the present work. The conditions for production and use of peat pellets have also been carried out.(author).

25514 **(TVA/PE/PSO—85/2) Evaluation of fossil plants versus hydro plants for load frequency control.** Broadwater, R.P.; Johnson, R.L.; Duckett, F.E.; Boston, W.T. (Tennessee Valley Authority, Chattanooga (USA). Div. of Power System Operations). 1985. 6p. NTIS, PC A02/MF A01. File Number DE85901313.

The economics of using hydroplants with Francis turbines or fossil plants for load frequency control are evaluated. Using data from the TVA Gallatin steam plant and the TVA Cherokee, Wilson, and Fontana hydroplants, a cost comparison of different modes of operation for load frequency control was performed considering two plants at a time. The results showed that when the fossil plant was used for load frequency control instead of a hydro plant a lower system generation cost was incurred. Dynamic responses of fossil and hydro units, improved controls for fossil plants, and maneuvering costs of the Gallatin plant are also considered.

25515 **Pressurized fluidized bed Combustion technology.** Podolski, W.F. etc.; Graves, R.L. etc. Park Ridge, N.J.; Noyes Publications, Noyes Data Corporation (1983). 429p.

The technology of pressurized fluidized bed combustion (PFBC), particularly in its application to a coal-burning combined-cycle (CC) plant, is evaluated in this book. Engineering systems analyses are performed for advanced concept plant components-boiler systems, including combustors, air-handling and air-injection equipment, and heat exchangers; solids handling, injection and ejection systems; hot-gas cleanup equipment; instrumentation and control systems; and turbines-and materials of construction are technically assessed. Environmental performance as well as energy efficiency are examined, and economic considerations-cost and market potentialare briefly reviewed. A broad survey of the principal related research and development programs in the U.S. and other countries is included. Responses to a survey of PFBC developers are reviewed, with emphasis on high risk areas of the PFBC concept. Finally, a projection of the most likely technological developments and a summary of unresolved technical issues and problems are presented.

2002 Environmental Aspects

REFER ALSO TO CITATION(S) 25162, 25175, 26073, 26074

25516 **(EPRI-CS—3976) Intake research facilities manual. Final report.** McGroddy, P.M.; Pease, T.E.; Matousek, J.A.; Edson, R.B. (Lawler, Matusky and Skelly Engineers, Pearl River, NY (USA)). May 1985. 207p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920623.

The objective of the project was to assemble descriptive information on testing facilities that could be used for future investigations of technologies designed to reduce losses of aquatic organisms at cooling water intakes. The manual is intended for use by utilities and their contractors to determine when existing test facilities can be utilized for future research. A list of 34 facilities was developed, and descriptive information on the environment, physical layout, and capabilities of each facility was collected for presentation on standardized sheets. Reference lists of the facilities, sorted into groups based on waterbody type, geographic location, intake type, available fish species, and intake technology, are presented to facilitate identification of groups of facilities with similar characteristics. The reference lists and descriptive information will allow efficient preliminary site evaluation by utilities interested in future intake technology research. 11 refs., 66 figs., 8 tabs.

25517 **(EPRI-EA—1901-1) Legionnaires' Disease Bacteria in power plant cooling systems: downtime report. Final report.** Tyndall, R.L.; Solomon, J.A.; Christensen, S.W. (Oak Ridge National Lab., TN (USA)). Apr 1985. Contract AC05-84OR21400. 45p. NTIS, PC A03/MF A01; 1 - Research Reports Center, Box 50490, Palo Alto, CA 94303; GPO Dep. File Number DE85005925.

Legionnaires' Disease Bacteria (Legionella) are a normal part of the aquatic community that, when aerosolized, can be pathogenic to man. The downtime study was designed to determine the degree to which Legionella populations are aerosolized during cleaning and maintenance operations in a closed-cycle steam-electric power plant. Both high-volume and impinger air samples were collected prior to and during downtime operations. Emphasis was placed on sampling inside or adjacent to water boxes, condensers, and cooling towers. Control air samples were taken upwind from the plant site. Water and sludge samples were also collected at various locations. In the laboratory, the concentrations of Groups A, B, and C Legionella were determined using the direct fluorescent antibody method. All positive air samples, and other selected air samples, were injected into guinea pigs to detect infectious Legionella. Legionella could be detected in only 12 of the 126 air samples collected. These were predominantly Group A Legionella (L. pneu-

mophila, serogroups 1 to 6). All 12 positive samples had been collected in the vicinity of water boxes, condensers, detention ponds, and cooling towers during downtime operations where aerosolization of Legionella populations would be expected. None of the air samples yielded infectious Legionella when injected into guinea pigs. Detection of Legionella in air samples taken during downtime was significantly more likely than detection during normal operating conditions ($p < 0.01$). 13 refs., 4 figs., 10 tabs.

25518 **(LBL—19398) Kinetics of combined SO_2/NO in flue gas clean-up.** Chang, S.G.; Littlejohn, D. (Lawrence Berkeley Lab., CA (USA)). Mar 1985. Contract AC03-76SF00098. 35p. (CONF-850357—10). NTIS, PC A03/MF A01; GPO Dep. File Number DE85011160.

From Spring national meeting of AIChE; Houston, TX, USA (24 Mar 1985).

The kinetics of reactions involving SO_2, NO, and ferrous chelate additives in wet flue gas simultaneous desulfurization and denitrification scrubbers are discussed. The relative importance of these reactions are assessed. The relevance of these reactions to spray dryer processes for combined SO_2/NO flue gas clean-up is addressed. 37 refs., 7 figs.

25519 **(PB—85-157519/XAB) Study on vanadium in workers from oil-fired power plants. Final report.** Sabbione, E.; Maroni, M. (Commission of the European Communities, Luxembourg). [1985]. 43p. (EUR—9005-EN). NTIS, PC E03/MF E01.

No symptoms or signs of illness have been detected in the workers during or after exposure so that occurrence of acute vanadium intoxication can be excluded. No information at all may be provided on possible long term health effects. Human tissues usually contain very small concentrations of vanadium (1-10 ppb) and the total amount of vanadium is very small in unexposed subjects. The vanadium quantities absorbed by the workers under study have sometimes been large enough to significantly increase the vanadium bioavailability of tissues. The possible biological effects of such an increase are still undefined.

25520 **(PB—85-163459/XAB) Health hazard evaluation report No. HETA 81-278-1371, Warrick Generating Station, Yankeetown, Indiana.** Zey, J.N.; Donohue, M. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Sep 1983. 40p. NTIS, PC A03/MF A01.

Environmental samples were collected to evaluate employee exposures to airborne concentrations of nitrogen dioxide, nitric oxide, sulfur dioxide, coal dust, fly ash, crystalline silica, and inorganic metals. In addition, gas leaks from the boilers were evaluated. While the majority of personal samples were below current criteria, a health hazard did exist for some employees exposed to sulfur dioxide, coal dust, and crystalline silica. Highest concentrations were obtained on samples worn by electrical and maintenance personnel and employees working on the positive pressure boiler (unit 4). In addition, the potential exists for employee exposure to boiler gases due to boiler leaks. Respiratory symptoms of cough, phlegm production, and wheezing were twice the expected rate for this group of workers. If preventive maintenance and engineering measures are employed, the occurrence of continued group health effects will likely be reduced. Recommendations are made in the body of the full report for an improved respiratory protection program, reducing leaks from boiler units, and for periodic environmental monitoring of the employees.

25521 **(PB—85-163467/XAB) Health hazard evaluation report No. HETA 81-112-1372, Culley Generating Station, Yankeetown, Indiana.** Zey, J.N.; Donohue, M. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Sep 1983. 40p. NTIS, PC A03/MF A01.

To evaluate worker exposure to boiler gases and coal dust, NIOSH conducted a combined environmental and medical evaluation at the Culley facility in August 1981. Environmental samples were collected to evaluate employee exposure to airborne concentrations of nitrogen dioxide, nitric oxide, sulfur dioxide, coal dust, fly ash, crystalline silica, and asbestos. In addition, boiler gas leaks were evaluated. While the majority of personal samples were below current criteria, a health hazard did exist for some employees exposed to sulfur dioxide. In addition, a potential for exposure to boiler gases exists due to boiler leaks. Respiratory symptoms of cough, phlegm production, and wheezing were twice the expected rate for this group of workers. The X-ray data revealed four cases of pneumoconiosis in the Culley workers. The relative youth and the low seniority of this workforce may explain the absence of group PFT reductions. If preventive engineering measures are employed, the occurrence of continued group health effects will likely be reduced. Recommendations are made for an improved respiratory protection program, reducing leaks from process equipment, and for periodic environmental monitoring of the employees.

2003 Power Transmission And Distribution

REFER ALSO TO CITATION(S) 25701

25522 **(CE-Trans—7985) Switching characteristics of metal-encapsulated SF_6-insulated high voltage isolating switches.** Koenig, D.; Fellmann, K.H. Translated from *ETZ Archiv (Berlin) (archiv fuer Elektrische Energietechnik der ETZ)* ; 2: No. 5, 161-163(1980). 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85901150. DE85901150

An insight into some problems associated with the testing of the switching characteristics of compressed-gas insulated metal-encapsulated high-voltage isolators is presented. The first test results are given for a model isolating switch with SF_6 insulation and for a commercial isolating switch. The characteristic pre- and restrike sequences are recorded on an oscilloscope and the overvoltage factors in the present test circuits are determined as a function of the operating voltage and the load capacity.

25523 **(CE-Trans—7979) Generation and propagation of transient overvoltages.** Vogel, O. Translated from *ETZ-A, Elektrotechnische Zeitschrift* ; 97: No. 1, 2-6(1976). 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85901250. DE85901250

A discussion of the origin of transient overvoltages is presented. Sources of overvoltage occur in switching with isolator switches, transient waves, transformer secondary lines, and grounding. Transient overvoltages in SF_6 systems are briefly discussed. (BCS)

25524 **(CE-Trans—7982) Results of measurements of transient overvoltages in outdoor switching stations.** Menge, H.D. Translated from *ETZ-A, Elektrotechnische Zeitschrift* ; 97: No. 1, 15-17(1976). 9p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85901157. DE85901157

The complex relationships existing during the generation and propagation of transient overvoltages required a large number of measurements in 380, 220 and 110 kV installations of different types. The transient overvoltages were generated by the operational switching of isolating switches at operating voltage and measured at the end of the secondary lines of instrument transformers particularly affected. The test results from 1650 oscillograms confirm that considerable overvoltages occur in systems built up to now - in individual cases more than 15 kV have been observed. In systems built in accordance with the VDEW Recommendations it is generally possible to decrease the voltages to values of less than 1 kV. Without these measures, 30% of all measured values are less than 0.5 kV and with these measures it is nearly 90%. A particularly effective measure has been the earthed shielding of secondary cables. The frequencies are between 1 MHz and 5 MHz and the decay times to 10% of the initial value are between 4 and 20 μs.

25525 **(CE-Trans—7983) Requirements placed on information processing equipment.** Zube, B. Translated from *ETZ-A, Elektrotechnische Zeitschrift* ; 97: No. 1, 18-19(1976). 7p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85901156. DE85901156

In this report the various programs are considered and reference is made to the fact that adequate protection both of conventional and of modern static equipment, and thus also the reliable operation of transmission systems and equipment is possible with strict applications of the measures recommended by the VDW.

25526 **(CE-Trans—7981) Measuring transient overvoltages in outdoor switching systems.** Latzel, G. Translated from *ETZ-A, Elektrotechnische Zeitschrift ;* **97**: No. 1, 13-15(1976). 6p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85901158. DE85901158

The amplitude of the overvoltage pulses occurring in the measuring and secondary lines of outdoor switching systems during the switching with isolating switches is also determined by a few obscure parameters such as soil condition, special system configuration and types of high-voltage equipment used. Measurements used to determine the risk to system reliability and the necessity and effectiveness of the measures for reducing transient overvoltages are discussed. The various test methods and connection of the test instruments required are also discussed.

25527 **(CE-Trans—7980) Effects of transient overvoltages and co-ordinating the remedies.** Hubensteiner, H. Translated from *ETZ-A, Elektrotechnische Zeitschrift ;* **97**: No. 1, 6-9(1976). 13p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85901159. DE85901159

The effects and the possibilities of controlling transient overvoltages are indicated. Reports show in greater detail the respective measures taken. Beyond dealing with the technical problems, however, it is also intended to provide here an insight into the work done by the various technical groups which have to deal with this subject.

25528 **(CE-Trans—7984) Comments to the discussion on transient overvoltages. Special test results from practical system experience.** Pasel, K.; Strnad, A.; Haug, O. Translated from *ETZ-A, Elektrotechnische Zeitschrift ;* **97**: No. 1, 20-27(1976). 25p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85901155. DE85901155

Papers dealing with different individual problems concerning transient overvoltages are presented. Test results of different transmission systems are briefly discussed. Measures taken by equipment manufacturers in order to prevent interference or destruction by overvoltages are included.

21 NUCLEAR POWER PLANTS

REFER ALSO TO CITATION(S) 25643, 25644, 25645, 25646

25529 **(INIS-mf—9522) NEA activities in 1983. 12. Activity report.** (Nuclear Energy Agency, 75 - Paris (France)). 1984. 43p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85700615.

Also published in French.

This report describes the main features of the Agency's work during 1983 and discusses the state and prospects of the nuclear industry in OECD countries. Trends in nuclear power, nuclear development and the fuel cycles nuclear safety technology and licensing, radiological and environmental impacts of nuclear fuel cycle activities, legal affairs, nuclear science, joint undertakings and other NEA joint projects, organisation and administration are reviewed.

25530 **(NUREG/CR—4051) Assessment of job-related educational qualifications for nuclear power plant operators.** Saari, L.M.; Melber, B.D.; White, A.S. (Battelle Human Affairs Research Center, Seattle, WA (USA); Pacific Northwest Labs., Richland, WA (USA)). Apr 1985. Contract AC06-76RL01830. 85p. (PNL—5303; BHARC—400/84/025). NTIS, PC A05/MF A01 - GPO $4.50. File Number TI85010458.

This report identifies job-related educational qualifications for the nuclear power plant licensed operator positions of reactor operator (RO), senior reactor operator (SRO), and shift supervisor (SS). The extent to which college engineering curriculum covers job-related academic knowledge was assessed. The approach used was to have subject matter experts in the field of general and nuclear engineering curriculum systematically compare college engineering program content to specific academic knowledge identified by a job analysis as necessary for licensed operators. In addition, these experts made judgments concerning levels of formal engineering education necessary for application of knowledge on the job, based on job samples from a job analysis of activities under selected normal and emergency operating sequences.

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

REFER ALSO TO CITATION(S) 25336, 25566, 25582, 25585, 25602, 25604, 25605, 25607, 25608, 25623, 25632, 25633, 25634, 25635, 25636, 25641, 25647, 25648, 25651, 25653, 25655, 25656, 25657, 26101

25531 **(CONF-850412—) Training of nuclear facility personnel: proceedings of the sixth symposium.** (Oak Ridge National Lab., TN (USA)). Apr 1985. Contract AC05-84OR21400. 299p. NTIS, PC A13/MF A01; 1; GPO Dep. File Number DE85010098.

From 6. symposium on the training of nuclear facility personnel; Nashville, TN, USA (15 Apr 1985).

Separate abstracts are included for each of the papers presented concerning excellence in operator training; achieving excellence through the accreditation process; managing and organizing the training function; operations training methods and processes; the role of simulators in achieving excellence; maintenance and technical training methods and processes; staffing and qualifying the training organization; and measuring training effectiveness.

25532 (DOE/ER/10275—1A, pp 5, Paper 5) **Investigation of the axial kinematic wave velocity profile in BWR fuel bundles.** Fahley, J.M. (Univ. of Washington). 1982. NTIS, PC A03/MF A01. File Number DE83004080. (CONF-820359—Absts.).

From Western regional American Nuclear Society student conference; Corvallis, OR, USA (28 Mar 1982).

25533 **(DOE/ET/34203—T6) Dresden Unit Two: dilute chemical decontamination and alternate water chemistry. Progress report, May 1978.** Blomgren, J.C. (Commonwealth Research Corp., Chicago, IL (USA)). 6 Jul 1978. Contract AC02-76ET34203. 7p. (COO—2985-10). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004671.

The following tasks are reported: (dilute chemical decontamination) solvent development, corrosion testing, pilot loop, (alternate water chemistry) N-16 dose rate, offgas system, leakage monitoring, materials, condensate treatment, additives.

25534 **(DOE/ET/34203—T8) Dresden Unit Two: dilute chemical decontamination and alternate water chemistry. Progress report, March 1978.** Blomgren, J.C. (Commonwealth Research Corp., Chicago, IL (USA)). 5 May 1978. Contract AC02-76ET34203. 7p. (COO—2985-8). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004675.

Dilute Chemical Decontamination Program highlights include solvent development, water purification, VNC test loop, corrosion products, and corrosion testing. The alternate water chemistry program includes the following tasks: additives, N-16 dose rates, offgas system, condenser leakage, materials, and condensate treatment. (DLC)

25535 **(DOE/ET/34203—T11) Dresden Unit Two: on-line decontamination and alternate water chemistry. Progress report, February 1978.** Blomgren, J.C. (Commonwealth Research Corp., Chicago, IL (USA)). 5 Apr 1978. Contract AC02-76ET34203. 6p. (COO—2985-7). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004674.

The On-Line Decontamination program highlights include solvent development, water purification, VNC demo loop, corrosion products, and corrosion testing. The highlights for the alternate water chemistry program include additives, N-16 dose rate, offgas system, condenser leakage monitoring, materials compatibility, and additives. (DLC)

25536 **(DOE/ET/34205—T1) Dresden Unit 1: chemical cleaning. Progress report, November 1-December 1, 1977.** Graves, J.S. (Commonwealth Research Corp., Chicago, IL (USA)). 15 Dec 1977. Contract AC02-76ET34205. 33p. (COO—4014-9). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85004666.

This report has been prepared for Dow Nuclear Services (DNS) and Commonwealth Edison Company (CECo) as part of the licensing activity for Dresden Unit 1. The report contains the estimated man-rem exposure for all work involved in the chemical cleaning, except the work of performing the cleaning and of processing and concentrating the radioactive material prior to shipping it to the burial ground. All back-up documentation is included in the report. The material will be useful in three ways. It will provide a total man-rem estimate for the license activity. This estimate is supportable based on actual construction practice in the nuclear industry. It will also allow dose goals for specific tasks to be assigned during the construction phase of the work. It will also permit management to evaluate specific jobs in order to change work steps to reduce total radiation exposure. Since standard work practices are the basis for this estimate, there will be areas where dose reduction can be accomplished.

25537 **(EPRI-NP—3684-SR-Vol.1) Seminar on countermeasures for pipe cracking in BWRs: proceedings. Volume 1. Problem resolution.** (Electric Power Research Inst., Palo Alto, CA (USA)). Sep 1984. 238p. (CONF-8311208—Vol.1). Research Reports Center, Box 50490, Palo Alto, CA 94303 $22.00. File Number TI85920101.

From 2. seminar on countermeasures for pipe cracking in BWRs; Palo Alto, CA, USA (15 Nov 1983).

The second seminar on countermeasures for BWR pipe cracking was held late in 1983 in Palo Alto, California. The results of nearly four years of R & D on pipe cracking, jointly sponsored by the BWR Owners Group and EPRI, was presented. Some 60 papers were delivered by organizations within the United States and overseas. The significance of this program to the utility industry is the development, qualification, and implementation of a large number of countermeasures for the problems of pipe cracking in BWRs. Countermeasures are available for both operating plants and plants under construction. In particular, the Japanese papers clearly demonstrated the success of the countermeasures with several years of crack-free operation in a number of BWRs. The report is published in three volumes corresponding to the three divisions of the seminar: Volume 1: Problem Resolution; Volume 2: Remedy Development; and Volume 3: Remedy Application. Volume 1 includes a list of authors of the written reports submitted and the agenda of the four-day meeting.

25538 **(EPRI-NP—3831) Evaluation of primary system decontamination at the Monticello Nuclear Generating Plant.** Asay, R.H.; Guastaferro, C.T. (Radiological and Chemical Technology, Inc., San Jose, CA (USA)). Apr 1985. 52p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920594.

The LOMI process was used at Monticello to decontaminate the primary recirculation piping. This process was shown to be a successful technique for decontaminating BWR piping to residual radiation levels comparable to those achieved by other conventional techniques. The decontamination factors achieved by the LOMI process at Monticello were good, ranging from approximately 4 to 60.

25539 **(EPRI-NP—3946) Equipment operability under high-frequency excitation. Final report.** Vasudevan, R. (Los Alamos Technical Associates, Inc., San Jose, CA (USA)). Apr 1985. 106p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920593.

An analytic technique developed from US Army testing provides a reliable first-cut alternative to testing the ability of individual units of BWR equipment to operate under high-frequency loads. Utilities could apply the new method to assess the effects of severe vibrations on a wide range of electrical and mechanical equipment in all types of power facilities.

25540 **(EPRI-NP—3970M) Crack growth rates in Type-304 stainless steel in simulated BWR water.** Macdonald, D.D.; Cragnolino, G.; Chung, P.C.; Yoshitake, A. (Ohio State Univ., Columbus (USA). Dept. of Metallurgical Engineering). Mar 1985. 48p. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303. File Number TI85920560.

When applied electrochemical potential is less than a critical value, intergranular cracking in Type-304 stainless steel ceases. The study of BWR pipe cracking that produced this new finding also developed an inexpensive and sensitive device for measuring crack growth rates.

25541 **(NUREG/CR—3746-Vol.3) LWR pressure vessel surveillance dosimetry improvement program. 1984 annual report, October 1, 1983-September 30, 1984.** McElroy, W.N.; Kam, F.B.K.; Grundl, J.A.; Fabry, A.; McGarry, E.D. (Hanford Engineering Development Lab., Richland, WA (USA)). Apr 1985. Contract AC06-76FF02170. 107p. (HEDL-TME—84-31-Vol.3). NTIS, PC A06/MF A01 - GPO $4.75. File Number TI85010597.

This report describes progress made in the Light Water Reactor Pressure Vessel Surveillance Dosimetry Improvement Program (LWR-PV-SDIP) during FY 1984. The primary concern of this program is to improve, test, verify, and standardize the physics-dosimetry-metallurgy and the associated reactor and damage analysis procedures and data used for predicting the integrated effects of neutron exposure to LWR pressure vessels and support structures. These procedures and data are being recommended in a new and updated set of ASTM standards being prepared, tested, and verified by program participants. These standards, together with parts of the US Code of Federal Regulations and ASME codes, are needed and used for the assessment and control of the condition of LWR pressure vessels and support structures during the 30- to 60-year lifetime of a nuclear power plant.

25542 **(NUREG/CR—3950-Vol.1) Fuel performance annual report for 1983. Volume 1.** Bailey, W.J.; Dunenfeld, M.S. (Pacific Northwest Labs., Richland, WA (USA)). Mar 1985. Contract AC06-76RL01830. 119p. (PNL—5210-Vol.1). NTIS, PC A06/MF A01 - GPO $5.00. File Number TI85009145.

This annual report, the sixth in a series, provides a brief description of fuel performance during 1983 in commercial nuclear power plants. Brief summaries of fuel design changes, fuel surveillance programs, fuel operating experience, fuel problems, high-burnup fuel experience, and items of general significance are provided. References to additional, more detailed information and related NRC evaluations are included.

25543 **Operation of Perry Nuclear Power Plant, Units 1 and 2, Docket Nos. 50-440 and 50-441, Ohio.** *EIS (Environmental Impact Statements);* 6: No. 11, 6-7(Nov 1982).

The abstract of a final environmental impact statement (EIS) on an operating license application for units one and two at the Perry Nuclear plant in Ohio describes the heat output of the boiling water reactor, with cooling of the exhaust steam in a closed-loop system having natural draft towers. Lake Erie will provide makeup water for the system. The two units will improve power reliability in the area as well as benefits from lower fuel costs, higher employment, and additional tax revenues. The negative impacts include the use of 1100 acres for construction and rights of way, lake water consumption for cooling, and interference with bird flight. The Nuclear Regulatory Commission regulations provide the legal mandate for the EIS.

2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

REFER ALSO TO CITATION(S) 25336, 25531, 25541, 25542, 25582, 25585, 25601, 25602, 25603, 25606, 25607, 25608, 25609, 25610, 25614, 25621, 25622, 25623, 25625, 25631, 25632, 25633, 25634, 25635, 25636, 25638, 25641, 25647, 25648, 25649, 25651, 25653, 25657

25544 (CONF-811042—9) **Base neutron noise in PWRs.** Kosaly, G.; Albrecht, R.W.; Dailey, D.J.; Fry, D.N. (Oak Ridge National Lab., TN (USA)). 1981. Contract AC05-84OR21400. 20p. NTIS, PC A02/MF A01. File Number TI85004511.

From 9. water reactor safety research information meeting; Washington, DC, USA (26 Oct 1981).

Considerable activity has been devoted in recent years to the use of neutron noise for investigation of problems in pressurized-water reactors (PWRs). The investigators have found that neutron noise provides an effective way to monitor reactor internal vibrations such as vertical and lateral core motion; core support barrel and thermal shield shell modes, bending modes of fuel assemblies, and control rod vibrations. However, noise analysts have also concluded that diagnosis of a problem is easier if baseline data for normal plant operation is available. Therefore, the authors have obtained ex-core neutron noise signatures from eight PWRs to determine the similarity of signatures between plants and to build a base of data to determine the sources of neutron noise and thus the potential diagnostic information contained in the data. It is concluded that: (1) ex-core neutron noise contains information about the vibration of components in the pressure vessel; (2) baseline signature acquisition can aid understanding of plant specific vibration frequencies and provide a bases for diagnosis of future problems if they occur; and (3) abnormal core support barrel vibration can most likely be detected over and above the plant-to-plant signature variation observed thus far.

25545 (DOE/ER/10275—1A, pp 2, Paper 8) **One-dimension transient model for once through steam generator.** Luo, S.T. (Oregon State Univ., Corvallis). 1982. NTIS, PC A03/MF A01. File Number DE83004080. (CONF-820359—Absts.).

From Western regional American Nuclear Society student conference; Corvallis, OR, USA (28 Mar 1982).

Besides the reactor itself, the steam generator is one of the principal components in a pressurized water reactor (PWR). The steam generator transfers the heat from the primary loop to the secondary loop. Heat is generated by fission in the reactor core. It is convected from there by the primary coolant and passed on to the secondary loop by way of the steam generator. Eventually heat is transformed to electric power by the turbine-generator. As shown in this simple scheme, the steam generator therfore is the coupling link between the primary and the secondary loop in the PWR plant. This indicates that it is essential to have a good understanding of the steady-state and transient behavior of the steam generator for predicting PWR response under normal and accidental conditions. First we review the basic model of the steam generator description, including the basic assumptions, conservation equations and state equations. Two-phase conditions are descriptions in terms of the homogeneous equilibrium model. Then we use a numerical technique to derive the difference equation. Last we present a flow chart of steady state and transient calculations.

25546 (EGG-TMI—6685) **Preliminary report: examination of H8 and B8 leadscrews from Three Mile Island Unit 2 (TMI-2).** Vinjamuri, K.; Akers, D.W.; Hobbins, R.R. (EG and G Idaho, Inc., Idaho Falls (USA)). Apr 1985. Contract AC07-76ID01570. 243p. NTIS, PC A11/MF A01; GPO Dep. File Number DE85010919.

One of the TMI-2 core examination tasks is the analysis of the control rod drive leadscrews, which were removed from the reactor head as part of the July 1982 closed-circuit television inspection of the damaged core. One leadscrew was removed from each of three different core positions: H8, from the center of the core; E9, from approximately midradius; and B8, from near the outer edge. This report presents and discusses the following: leadscrew acquisition, sample types, and analytical techniques used to analyze the various types of samples; results from the visual examination; preliminary leadscrew surface temperature estimates; chemical and radiological analyses; comparisons of temperature estimates and the chemical and radiological behavior in the plenum assembly region; and the principal observations and recommendations made on the basis of this study.

25547 (EPRI-NP—3574-SR, pp 1.1-1.15) **Operating chemistry history of Millstone Unit 2.** Fackelmann, J.M. (Northeast Utilities, Hartford, CT). Oct 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $26.50. File Number TI85920098. (CONF-8210321—Summs.).

From Workshop on pitting in steam generator tubing; Pittsburgh, PA, USA (28 Oct 1982).

An outline is presented of the pitting that appeared in the steam generator of the Millstone Point Unit 2 plant between the December 1980 and December 1981 inspections. The pit growth required plugging of 704 tubes. In contrast, Millstone had plugged only 800 tubes from 1975 through 1981 from all other causes, including denting.

25548 (EPRI-NP—3574-SR, pp 2.1-2.16) **Destructive examination of Millstone tubes.** Habicht, P.R. (Northeast Utilities, Berlin, CT). Oct 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $26.50. File Number TI85920098. (CONF-8210321—Summs.).

From Workshop on pitting in steam generator tubing; Pittsburgh, PA, USA (28 Oct 1982).

The results of the destructive examination of the Millstone Reactor steam generator tubes are presented. It was found that the tubes were pitted between the tube sheet and the first support in the sludge pile and that piting was predominant on the cold leg side.

25549 (EPRI-NP—3574-SR, pp 3.1-3.10) **Examination of Indian Point 3 steam generator tube R12C66.** Agrawal, A.K. (Battelle Columbus Labs., OH). Oct 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $26.50. File Number TI85920098. (CONF-8210321—Summs.).

From Workshop on pitting in steam generator tubing; Pittsburgh, PA, USA (28 Oct 1982).

Indian Point No. 3 started producing power on August 30, 1976. The plant since has operated on an All-Volatile-Treatment (AVT) chemistry. A leak from the primary side to secondary side was discovered while hydrotesting steam generator No. 31 during a maintenance period in September 1981. Eddy current (EC) inspection showed that many possible tube defects existed in all four of the steam generators on the cold leg side. Practically all EC indications were located between the tube sheet and the first support plate. Sludge deposits containing large amounts of copper were reported on the tube sheet. Tubes affected were mostly confined to the inner core of 30 tubes in each steam generator. A tube from Row 12 Column 66 (R12C66) was pulled out from the cold leg side of steam generator N. 31, and shipped to Battelle for an independent evaluation. The results of the failure analysis are presented. The probable cause of attack and events responsible for this attack are discussed.

25550 (EPRI-NP—3574-SR, pp 4.1-4.15) **Summary of Indian Point No. 3 operating chemistry experience.** Gillen, J. (New York Power Authority, Buchanan). Oct 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $26.50. File Number TI85920098. (CONF-8210321—Summs.).

From Workshop on pitting in steam generator tubing; Pittsburgh, PA, USA (28 Oct 1982).

The operating annual average chemistry for the Indian Point No. 3 Reactor is shown. The steam generator blowdown chloride history after the turbine blade failure (which damaged 54 condenser tubes) on 1/31/81 is presented. Subsequent to this incident (chloride levels ~ 400 ppm), the steam generators were filled with demineralized water and then sparged with nitrogen until the dissolved oxygen level was ≤5 ppb. This filling, sparging, and draining of the steam generators continued until the unit started up in April. The unit operated from April to September 1981 when it was shutdown for a routine outage. During normal startup testing a primary

to secondary leak developed in the 31 steam generator. Subsequent eddy current examination showed that ~ 500 tubes degraded in each steam generator. Included within this group were a number of tubes with a very large copper signal (i.e., a defective tube could not be distinguished from the copper signal). Tube samples were removed, analyzed and pitting was identified as the cause of failure. At the present time several possible pit initiating criteria are being studied, for example resin intrusion, wet and/or dry lay-up, and power operation with high levels of contaminants from condenser cooling water ingress.

25551 (EPRI-NP—3574-SR, pp 6.1-6.18) **Discussion on plant conditions.** Pearl, W. (NWT Corp., San Jose, CA). Oct 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $26.50. File Number TI85920098. (CONF-8210321—Summs.).

From Workshop on pitting in steam generator tubing; Pittsburgh, PA, USA (28 Oct 1982).

An outline is presented of the operting conditions at 10 nuclear power plants. These are Calvert Cliffs 1, Ginna, Surry 2, Trojan, Turkey Point 4, St. Lucie 1, Millestone 2, Indian Point 2, ANO-1, and Crystal River 3.

25552 (EPRI-NP—3574-SR, pp 7.1-7.16) **Laboratory pitting experience under lay-up and high temperature heat transfer conditions.** Wolfe, C.R. (Westinghouse Electric Corp., Pittsburgh, PA). Oct 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $26.50. File Number TI85920098. (CONF-8210321—Summs.).

From Workshop on pitting in steam generator tubing; Pittsburgh, PA, USA (28 Oct 1982).

The work, performed at lay-up temperatures, showed that: pitting of Inconel-600 can occur at lay-up conditions with contaminant concentration of about 700 ppm chloride, present either as air saturated seawater or as cupric chloride; pitting of Inconel-600 at lay-up conditions can be effectively inhibited even in aggressive chloride pitting environments by decreasing the solution oxygen content to 10 ppb (0.010 ppm) or less in a seawater environment and increasing the pH to 8.5 or greater by the addition of ammonium hydroxide; at copper ion concentrations of less than 70 ppm in a neutral chloride solution no pitting of Inconel-600 was observed at simulated layup conditions; and hydrazine or amerzine addition to the pitting chemistry had little effect on the Inconel-600 pitting in an aggressive environment, i.e., copper chloride, but was somewhat effective in limiting pitting in a sea water environment.

25553 (EPRI-NP—3574-SR, pp 8.1-8.27) **Pitting in the laboratory at Combustion Engineering.** Hall, J.F. (Combustion Engineering, Inc., Windsor, CT). Oct 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $26.50. File Number TI85920098. (CONF-8210321—Summs.).

From Workshop on pitting in steam generator tubing; Pittsburgh, PA, USA (28 Oct 1982).

Prior to the incidents at Indian Point-3 and Millstone Point-2, only shallow pitting had been observed in PWR steam generator tubes removed from service. The maximum pit depths measured in tubes removed from C-E plants prior to 1982 were approximately 0.005 inch. The pitting was sufficiently minor that the pits were not detected by ECT nor did the existence of these pits promote concern about possible primary to secondary leakage. Over the past 10 years, numerous model and pot boiler tests and isothermal capsule tests were conducted to assess the potential for or to duplicate various types of corrosion in steam generator tubes and/or support structures. These tests were successful in producing, in Alloy 600 heat transfer tubing, such phenomena as phosphate wastage, caustic stress corrosion cracking, denting and intergranular attack induced by degradation of condensate polisher resins. Similarly, corrosion of support materials was produced in the laboratory. During some of the tests to duplicate the above phenomena, pitting of the Alloy 600 heat transfer tubes in the pot and model boilers and in the Alloy 600 capsules occurred and was detected during post-test examinations. Like the prior field experience, the laboratory-produced pits were isolated, shallow and not detected by standard ECT tests. The results of the tests are outlined.

25554 (EPRI-NP—3574-SR, pp 9.1-9.12) **Simulation of pits on steam generator tubes under layup conditions.** Agrawal, A.K.; Berry, W.E. (Battelle Columbus Labs., OH). Oct 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $26.50. File Number TI85920098. (CONF-8210321—Summs.).

From Workshop on pitting in steam generator tubing; Pittsburgh, PA, USA (28 Oct 1982).

A piece of Inconel 600 tube which had been exposed in a model boiler under seawater faulted condition was used to simulate pitting on steam generator tubes under layup conditions. The model boiler tube was supplied by Combustion Engineering from EPRI Project 623-4. The tube had been prefilmed in the model boiler for 3-1/2 months under normal steam generator all-volatile chemistry conditions prior to exposure in seawater faulted environment. The pitting simulation was done in a beaker maintained at 170°F. Deep pits were produced in 10 days in a pH 5.0 environment containing 1 ppm S_2O_3/sup =/ and 1 ppm Cl^- ions. Experimental details and the results of the destructive analysis of the pits are presented.

25555 (EPRI-NP—3574-SR, pp 10.1-10.10) **Pitting studies of nickel alloys.** Scarberry, R.C. (Huntington Alloys, Inc., WV). Oct 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $26.50. File Number TI85920098. (CONF-8210321—Summs.).

From Workshop on pitting in steam generator tubing; Pittsburgh, PA, USA (28 Oct 1982).

The anticipation of chloride stress corrosion cracking led to the use of INCONEL alloy 600, which until about 1959 was considered to be immune to that form of attack. In the intervening years many studies enabled the industry to live with and to control stress corrosion cracking failures. Now it appears that the other localized corrosion mechanism has become the problem. In contrast to stress corrosion cracking, pitting is easy to see and even to understand. The concept of passivity breakdown and a small active anode corroding at a much higher rate than the surrounding cathode appears to be simple enough. However the simplicity of the attack is belied by the extreme difficulty of studying the phenomenon in the laboratory. The problems associated with studying pitting corrosion in the laboratory are discussed.

25556 (EPRI-NP—3574-SR, pp 11.1-11.7) **Laboratory studies of pitting mechanisms.** Isaacs, H.S. (Brookhaven National Lab., Upton, NY). Oct 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $26.50. File Number TI85920098. (CONF-8210321—Summs.). Contract AC02-76CH00016.

From Workshop on pitting in steam generator tubing; Pittsburgh, PA, USA (28 Oct 1982).

Pitting corrosion can be divided into three stages, initiation, propagation and repassivation. Little is known about the initiation of pits because the early stages are beyond most measuring techniques and only the later stages propagation and repassivation are generally observed. Studies which have been conducted at BNL on the factors which influence propagation and repassivation with stainless steels and nickel alloys are discussed. The half-life of pits were determined as a function of the surface preparation using a scanning reference electrode technique to locate and monitor active pitting. The life of a pit was found to be highly dependent on the passive oxide layer that was present prior to pitting and undermined by the pitting process. The thicker the oxide (e.g., by air oxidation below 350°C) the greater were the times before pits repassivated, while highly stressed surfaces (e.g., after abrasion) gave rapidly repassivating pits. Studies were conducted on the growth rate using artificial pits to determine the factors controlling corrosion rate in pits. These studies were carried out with pencil type electrodes. The rates were found to be either controlled by diffusion when a salt layer was present on the metal/saturated solution interface or by activation polarization. Calculations of the precipitation of salt films were conducted and repassivation characteristics determined on 304L and Alloy 600.

25557 (EPRI-NP—3574-SR, pp 12.1-12.6) **Discussion of laboratory pits.** Cubicciotti, D. (Electric Power Research Institute, Palo Alto, CA). Oct 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $26.50. File Number TI85920098. (CONF-8210321—Summs.).

From Workshop on pitting in steam generator tubing; Pittsburgh, PA, USA (28 Oct 1982).

The following observations were noted during laboratory studies of pitting corrosion: the pits were located near the top of the sludge, the cold leg is more affected than the hot leg, copper metal appeared in pits and on nearby tube surfaces, the pits were filled with layered oxide, the areas of wastage (tube wall thinning) were under scale near the pits, and excursions of impurities in coolant, i.e., (Cl^-, SO/sub x//sup =/); (O_2, Cu^{++}), H^+, SiO_2, were higher during shutdown and startup.

25558 (EPRI-NP—3574-SR, pp 13.1-13.6) **Pitting detection in the presence of conducting sludge.** Lareau, J.P.; Edwards, L.J. (Combustion Engineering, Inc., Windsor, CT). Oct 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $26.50. File Number TI85920098. (CONF-8210321—Summs.).

From Workshop on pitting in steam generator tubing; Pittsburgh, PA, USA (28 Oct 1982).

In steam generator examinations at two plants, the conventional multi-frequency eddy current test method was confirmed to have missed tube wall pitting greater than 50% through wall. The primary reasons for these misses were the small flaw volume relative to the ASME reference flaws and a high degree of signal interference caused by a sludge pile of conductive material (metallic copper rich sludge). In order to overcome this problem, an improved probe design and test procedure to enhance pit detection and sludge signal suppression were developed. A narrow field probe was built with a coil stack width approximately one half the nominal size and with a slightly greater fill factor. The probe was designed to operate at higher frequencies than the conventional 4080 Hz. By using a higher frequency and narrower coils, both the radial and axial field extent was reduced to enhance signals from small pits and reduce the sludge influence. A specific multi-parameter mixing procedure was used to bias out the signals from the sludge pile instead of the normal mix to eliminate support plates. Laboratory studies were conducted with chemically pitted tubes coated with simulated sludge. Eddy current testing was done before and after cleaning of the tubes. The results show the effectiveness of this technique to detect and size flaws both with and without the sludge interference.

25559 (EPRI-NP—3574-SR, pp 14.1-14.12) **Chemical cleaning.** Welty, C.E. (Electric Power Research Institute, Palo Alto, CA). Oct 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $26.50. File Number TI85920098. (CONF-8210321—Summs.).

From Workshop on pitting in steam generator tubing; Pittsburgh, PA, USA (28 Oct 1982).

In reference to the application of chemical cleaning, the following summary is provided: (1) The SGOG generic process includes a sludge removal cycle which can effectively remove AVT generated mixed copper and magnetic sludge and tube deposits. Process development is essentially complete, and tube specific qualification testing is the only work remaining. (2) The solvents in the SGOG generic process are not effective at removing the nickel-chrome rich deposit within the pit. Based on the experience and lessons learned in developing the SGOG generic process for removing magnetite from dented tube-to-support plate intersections, developing a new solvent and qualifying it for effectiveness and corrosion acceptability could be a very expensive and time consuming effort. As such, the benefit from moving the internal pit deposits (compared to other remedies) should be fully identified and verified prior to undertaking any new solvent development effort. (3) To the extent that sludge piles and tube surface deposits are either a causative or aggravating factor in the pitting problem, the sludge cycle of the SGOG generic process is available and could very well mitigate the problem.

25560 (EPRI-NP—3574-SR, pp 15.1-15.33) **Sleeving alloys: criteria - selection.** van Rooyen, D. (Brookhaven National Lab., Upton, NY). Oct 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $26.50. File Number TI85920098. (CONF-8210321—Summs.).

From Workshop on pitting in steam generator tubing; Pittsburgh, PA, USA (28 Oct 1982).

Placing a sleeve in a steam generator tube which has been damaged by pitting will create the obvious crevice between the original tube and the sleeve. In this crevice, one would have to consider which of the reactions apply to the material that would be in contact with either secondary or primary water (or both). Caustic can give stress corrosion cracking (SCC) or intergranular corrosion (IGC). Acid can give rise to pitting or if certain sulfur compounds are present, then possibly to IGC in sulfur or to transgranular SCC such as can occur in stainless steels in the presence of acid chlorides. Since corrosion products may eventually form between the sleeve and the original tube, it is also felt that the sleeve should be stronger than the tube so that deformation, if it occurs, would push the other tube somewhat further out and not obstruct the inside clearance. On the primary side, the choice is for the following remedies: a) stress relief, b) thermal treatment of Alloy 600, and c) alternate alloys such as 690 or choosing lower nickel materials.

25561 (EPRI-NP—3574-SR, pp 16.1-16.33) **Pitting resistant alloys.** Asphahani, A.I. (Cabot Corp., Kokomo, IN). Oct 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $26.50. File Number TI85920098. (CONF-8210321—Summs.).

From Workshop on pitting in steam generator tubing; Pittsburgh, PA, USA (28 Oct 1982).

High performance nickel-base alloys offer excellent resistance to pitting-crevice corrosion in various aggressive media. These alloys have been successfully used to handle severely corrosive environments in the chemical/petrochemical processing industries. The high molybdenum contents of these alloys makes their use a requirement in critical applications where pitting resistance is necessary. Several factors are known to affect alloys resistance to pitting-crevice corrosion. The effects of pH, temperature, chloride ions, oxidizing species, inhibitors, weld, heat treatment, cold work, heat transfer, and electrochemical polarization are exemplified. Alloying with molybdenum is needed to impart resistance to localized corrosive attack. With regard to stress corrosion cracking, the high performance nickel-base alloys are more resistance than the iron-base stainless steels. A higher nickel content is beneficial in providing resistance to chloride stress cracking as well as to caustic stress cracking. When combining both requirements (resistance to pitting-crevice corrosion and resistance to stress corrosion cracking), a Ni-Fe-Cr-Mo alloy appears to be a good choice for steam generator services. Alloy G-3 (Ni-20Fe-22Cr-7Mo-2Cu) is a commercially available material with a promising potential for applications in nuclear steam generators.

25562 (EPRI-NP—3574-SR, pp 17.1-17.13) **Clad tubing: its production, evaluation and operating experience.** Martin, J.M. (Huntington Alloys, Inc., WV). Oct 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $26.50. File Number TI85920098. (CONF-8210321—Summs.).

From Workshop on pitting in steam generator tubing; Pittsburgh, PA, USA (28 Oct 1982).

There is an interest in an Inconel alloy 625 clad Inconel alloy 600 or 690 tube to be used as a tube insert inside Inconel alloy 600T PWR steam generator tubes that are experiencing pitting attack. At final size these insert tubes will be about 3/4″ O.D. with a substrate wall of .040″ minimum with .005 to 010″ clad on the O.D. The Inconel alloy 625 clad, by its alloy composition, should offer superior resistance to pitting and crevice attack. The Inconel alloys 600 or 690 substrate will provide a matching structural support to that of the original tubes. These alloys also have a demonstrated superior resistance to caustic cracking than Inconel alloy 625. The production of 1.5″ Sch. 80 pipe (1.9″ O.D. x .190″ Wall with .042″ of O.D. cladding) redraw tubing for the experiences in providing clad tubing are discussed and how clad tubing is produced at Huntington Alloys, Inc. is briefly outlined.

25563 **(EPRI-NP—3574-SR, pp 18.1-18.28) Pitting of steam generator tubes and pitting resistance of sleeving alloys.** Daniel, P.L. (Babcock and Wilcox Co., Alliance, OH). Oct 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $26.50. File Number TI85920098. (CONF-8210321—Summs.).

From Workshop on pitting in steam generator tubing; Pittsburgh, PA, USA (28 Oct 1982).

A thick layer of sludge covers the tube sheets in the Millstone Unit 2 steam generators. Pits form on some of the Alloy 600 steam generator tubes where they pass through this sludge pile. Local conditions conducive to pitting arise because: (1) acidic salts concentrate where the sludgepile limits free flow of water over the superheater tube surface and (2) the sludge pile is a reservoir of cupric and other corrosive ions. A series of brief laboratory tests were undertaken: (1) to determine the extent to which certain environmental constituents cause pitting of the type observed in Millstone Unit 2 steam generators and (2) to test possible sleeving alloys. To meet time constraints, the tests were electrochemically accelerated. Effects of environmental chemistry, temperature, alloy, and alloy condition were investigated. The test temperatures were 75°F, 300°F, and 530°F. Alloys 690 and 825 are highly susceptible to pitting. Alloy 625 is generally resistant but may be subject to attack in the presence of silicates which may react with molybdenum. Other alloys are being investigated and appear to be highly resistant to this environment.

25564 **(EPRI-NP—3924-SR) Second EPRI workshop on support-structure corrosion in nuclear plant steam generators: proceedings.** Shoemaker, C.E. (ed.). (Electric Power Research Inst., Palo Alto, CA (USA)). Mar 1985. 608p. (CONF-8307150—). Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $44.50. File Number TI85920567.

From 2. EPRI workshop on support-structure corrosion in nuclear plant steam generators; Seattle, WA, USA (18 Jul 1983).

Some utilities may replace their steam generators partly due to corrosion of their carbon steel support plates. Proceedings of this workshop provide an update on test results of candidate materials and designs for support structures. Objectives of the workshop were: to summarize corrosion data of carbon steel due to various kinds of secondary water and hideout in prototypical crevices of steam generators, to define available options to minimize steam generator corrosion, to summarize reductions in crevice corrosion possible by substituting alloy steel for carbon steel in new steam generators, and to determine what future work, if any, is required to test or qualify new support structure materials and designs. The subject areas included: water chemistry limits to minimize corrosion of carbon steel (laboratory data), field corrosion data on carbon steel, hideout and return of salts in heated crevices, assessing causes of steam generator corrosion, the influence of support design on corrosion and comparing the corrosion of alternative alloys. The data are intended to provide utilities a data base for determining their particular design and material needs for support structures in new steam generators.

25565 **(EPRI-NP—3928) Evaluation of eddy-current procedures for measuring wear scars in preheat steam generators.** Brown, S.D. (Jones (J.A.) Applied Research Co., Charlotte, NC (USA)). Apr 1985. 36p. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303. File Number TI85920595.

Tests show that flat wear scar procedures will provide more accurate measurements of the depth of wear scars in steam generator tubes if they are supplemented by two new techniques. Used together, these methods can detect as little as 5% increase in scar depth.

25566 **(EPRI-NP—3944) Erosion/corrosion in nuclear plant steam piping: causes and inspection program guidelines. Final report.** Delp, G.A.; Robison, J.D.; Sedlack, M.T. (Technicon Enterprises, Inc., Oley, PA (USA)). Apr 1985. 81p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920580.

Wet-steam erosion/corrosion in nuclear power plant piping is a serious industrywide problem. Utilities can use these workable recommendations and inspection guidelines to mitigate and control this phenomenon and its effects on pipe wall degradation.

25567 **(EPRI-NP—3947) Procedures and equipment for shortening refueling outages in Babcock and Wilcox PWRs. Final report.** Baker, H.A.; Carr, C.W. (Babcock and Wilcox Co., Lynchburg, VA (USA). Utility Power Generation Div.). Apr 1985. 96p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920606.

New refueling equipment and procedures - plus a software package bid specification for outage management - can reduce refueling outages in Babcock and Wilcox PWRs. At Duke Power Company's Oconee nuclear station, a single modification in the fuel-handling system cut 5 days off the refueling schedule.

25568 **(EPRI-NP—3966-CCM-Vol.5) CEPAN method of analyzing creep collapse of oval cladding. Volume 5. Evaluation of interpellet gap formation and clad collapse in modern PWR fuel rods.** Adams, W.M.; Fisher, H.D.; Litke, H.J.; Mordarski, W.J. (Combustion Engineering, Inc., Windsor, CT (USA)). Apr 1985. 124p. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303. File Number TI85920610.

This report presents the results from a review of interpellet-gap formation, ovality, creepdown and clad collapse data in modern PWR fuel rods. Conclusions are reached regarding the propensity of modern PWR fuel to form such gaps and to undergo clad collapse. CEPAN, a creep-collapse predictor approved by the NRC in 1976, has been reformulated to include the creep analysis of cladding with finite interpellet gaps. The basis for this reformulation is discussed in detail. The model previously used in the calculation of the augmentation factor, a peak linear heat rate penalty due to the presence of interpellet gaps within the fuel rod, has been modified to incorporate gap-formation statistics from modern fuel. Finnally, the benefits of the limited gap formation and the CEPAN reformulation for the licensing of modern PWR fuel rods are evaluated.

25569 **(NUREG/CR—4004) Closeout of IE Bulletin 79-25: failures of Westinghouse BFD relays in safety-related systems.** Foley, W.J.; Dean, R.S.; Hennick, A. (Parameter, Inc., Elm Grove, WI (USA)). Apr 1985. 45p. NTIS, PC A03/MF A01 - GPO $4.00. File Number TI85901361.

Robinson 2 submitted LER 78-29 December 19, 1978 to report sticking of a normally energized Westinghouse BFD relay. After reviewing this problem, Westinghouse issued Service Letter TS-E-412 to recommend that BFD relays in safety-related systems be replaced with later NBFD relays, Robinson 2 found some with marginal or unsatisfactory armature overtravel. Because of this new problem, Westinghouse issued Technical Bulletin NSD-TB-79-05 to recommend prompt checking of certain models of NBFD relays and returning those with inadequate overtravel for rework or replacement. IE Bulletin 79-25, with extracts of the Westinghouse service letter and technical bulletin enclosed, was issued November 2, 1979 to require responses and specific actions by all licensees and holders of construction permits with respect to BFD and NBFD relays in safety-related systems. Evaluation of utility responses and NRC/IE inspection reports indicates that the bulletin can be closed out for 121 (94%) of the 129 current facilities on the basis of specific criteria. Proposed followup items for the remaining 8 facilities are presented in Appendix C for use by NRC/IE. Because follow-up of corrective action is ensured, IE Bulletin 79-25 is considered closed.

25570 **(NUREG/CR—4212) In-place thermal annealing of nuclear reactor pressure vessels.** Server, W.L. (EG and G Idaho, Inc., Idaho Falls (USA)). Apr 1985. Contract AC07-76ID01570. 252p. (EGG-MS—6708). NTIS, PC A12/MF A01 - GPO $6.50. File Number TI85010862.

Radiation embrittlement of ferritic pressure vessel steels increases the ductile-brittle transition temperature and decreases the upper shelf level of toughness as measured by Charpy impact tests. A thermal anneal cycle well above the normal operating temperature of the vessel can restore most of the original Charpy V-notch energy properties. The Amry SM-1A test reactor vessel was wet annealed in 1967 at less than 343°C (650°F), and wet annealing of the Belgian BR-3 reactor vessel at 343°C (650°F) has recently taken place. An industry survey indicates that dry annealing a reactor vessel in-place at temperatures as high as 454°C (850°F) is feasi-

ble, but solvable engineering problems do exist. Economic considerations have not been totally evaluated in assessing the cost-effectiveness of in-place annealing of commercial nuclear vessels. An American Society for Testing and Materials (ASTM) task group is upgrading and revising guide ASTM E 509-74 with emphasis on the materials and surveillance aspects of annealing rather than system engineering problems. System safety issues are the province of organizations other than ASTM (e.g., the American Society of Mechanical Engineers Boiler and Pressure Vessel Code body).

25571 **(CE-Trans—7878) Test on the morpholine treatment of the water-steam circuit at Fessenheim Power Station.** Gregoire, J. Translated from *Houille Blanche ;* No. 4/5, 307-313(1981). 18p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85900392. DE85900392

The two units at Fessenheim nuclear power station form the first of a series of 900 MW(e) PWR units in the French nuclear program. They were put into operation in April and October 1977, respectively. Each unit comprises a nuclear steam supply system and a turbine generator set. The NSSS comprises the nuclear reactor itself which supplies thermal energy, primary pumps circulating the coolant (pressurized water), and the three steam generators formed of U-shaped tubes. The coolant circulates inside these tubes (also called "primary" side). On the outside of the tubes ("secondary" side) the boiler feedwater, pre-heated in the feed-heaters, is heated in the tube nest and is evaporated above the latter. This article deals with the chemical treatment tests on the "secondary circuit" carried out by the Chemical Section of the EST Regional Thermal Production Group.

2103 Power Reactors, Non-breeding, Graphite Moderated

REFER ALSO TO CITATION(S) 25582, 25585, 25632, 25633, 25634, 25635, 25636, 25642

25572 **(CONF-7410193—) Technical papers presented at the nineteenth Dragon countries physics meeting held at Bologna, Italy, October 1974.** (Organization for Economic Co-Operation and Development, Winfrith (UK). High Temperature Reactor Project). 1974. 271p. NTIS (US Sales Only), PC A12. File Number DE85900463.

From 19. Dragon countries physics meeting; Bologna, Italy (17 Oct 1974).

Papers are presented concerning the following aspects of HTGR type reactors: core design; reactor kinetics; nuclear data; and critical assemblies.

25573 **(CONF-7506197—) Technical papers presented at the twentieth Dragon countries physics meeting, Paris, France, June 1975.** (Organization for Economic Co-Operation and Development, Winfrith (UK). High Temperature Reactor Project). 1975. 145p. NTIS (US Sales Only), PC A07. File Number DE85900468.

From 20. Dragon countries physics meeting; Paris, France (1 Jun 1975).

Papers are presented concerning the following aspects of HTGR type reactors: core design; reactor kinetics; fuel management; and fuel cycle costs.

2104 Power Reactors, Non-breeding, Otherwise Moderated Or Unmoderated

REFER ALSO TO CITATION(S) 25336, 25598, 25599

25574 **License renewal and power increase for the National Bureau of Standards reactor, Docket No. 50-184, Maryland.** *EIS (Environmental Impact Statements);* 6: No. 11, 5-6(Nov 1982).

An abstract of the final environmental impact statement (EIS) describes the purpose and probable effects of relicensing the National Bureau of Standards test reactor in Gaithersburg, Maryland. The renewal application seeks an expansion from 10 to 20 MW capacity for 20 years. Benefits for the expansion include more efficient research programs, particularly materials research activities. Negative impacts include an increase of Argon-41 and tritium releases to the atmosphere and waste water. Nuclear Regulatory Commission regulations are the legal mandate for the EIS.

2105 Power Reactors, Breeding

REFER ALSO TO CITATION(S) 25586, 25591, 25594, 25612, 25615, 25616, 25617, 25618, 25626, 25627, 25628, 25629, 25632, 25633, 25634, 25635, 25636, 25640, 25654

25575 **(CONF-850610—3) Expected behavior of plutonium in the IFR fuel cycle.** Steunenberg, R.K.; Johnson, I. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85006225.

From Annual meeting of the American Nuclear Society; Boston, MA, USA (9 Jun 1985).

The Integral Fast Reactor (IFR) is a metal-fueled, sodium-cooled reactor that will consist initially of a U-Zr alloy core in which the enriched uranium will be replaced gradually by plutonium bred in a uranium blanket. The plutonium is concentrated to the required level by extraction from the molten blanket material with a $CaCl_2$-$BaCl_2$ salt containing $MgCl_2$ as an oxidant (halide slagging). The $CaCl_2$-$BaCl_2$ salt containing dissolved $PuCl_3$ and UCl_3 is added to the core process where fission products are removed by electrorefining, using a liquid cadmium anode, a metal cathode, and a LiCl-NaCl-$CaCl_2$-$BaCl_2$ molten salt electrolyte. The product is recovered as a metallic deposit on the cathode. The halide slagging step is operated at about 1250° and the electrorefining step at about 450°C. These processes are expected to give low fission-product decontamination factors of the order of 100.

25576 **(DOE/CL/11200—T7) Projections of revenues from CRBRP operation and CRBRP investment analysis.** (Stoller (S.M.) Corp., New York (USA)). 16 Mar 1983. Contract AC15-76CL11200. 24p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85009022.

The possible revenues from the operation of CRBRP have been projected for a range of pricing scenarios for the sale of its electrical generation output. In order to keep the cases analyzed to a manageable number, the probable highest and lowest electricity price cases appropriate for CRBRP were included so that all other feasible and acceptable arrangements which would produce revenue streams for the CRBRP would be bounded. Other cases selected represent scenarios which could apply to specific utilities within reasonable transmission distance from CRBRP in the surrounding NERC regions.

25577 **(DOE/CL/98004—31) Cell liner design for LMFBR plants.** Palm, R.E.; Burrow, R.C. (Burns and Roe, Inc., Oradell, NJ (USA)). 1978. Contract AC15-76CL98004. 20p. (CONF-780609—22). NTIS, PC A02/MF A01; GPO Dep. File Number DE85009014.

From ASME/CSME pressure vessels and piping conference; Montreal, Canada (25 Jun 1978).

Those areas or cells within LMFBR plants that contain radioactive sodium systems are provided with certain design features which eliminate or limit potential sodium/concrete reaction and thus protect the concrete structure in the event of an accidental sodium spill. The principal design feature within these cells that controls sodium spill effects is the cell liner system. The development of such a system design for the Clinch River Breeder Reactor Plant (CRBRP) is presented in this paper. The basis for cell liner designs is described, including general design criteria, materials and welding requirements, system design requirements, load categories and loading combinations and allowable stress and strain levels. Results of stress analysis and design details of the cell wall and floor systems are presented, including provisions for protection of the concrete structure against high temperature effects.

25578 **(LA—10317-MS) TRANSPA: a code for transient thermal analysis of a single fuel pin.** Prenger, F.C. (Los Alamos National Lab., NM (USA)). Feb 1985. Contract W-7405-ENG-36. 33p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85010326.

An analytical model (TRANSPA) for the transient thermal analysis of a single uranium carbide fuel pin was developed. This model uses thermal boundary conditions obtained from COBRA-WC output and calculates the transient thermal response of a single fuel pin to changes in internal power generation, coolant flowrate, or fuel pin physical configuration. The model uses the MITAS finite difference thermal analyzer. MITAS provides the means to input separate conductance models through the use of a user subroutine input capability. The model is a lumped-mass representation of the fuel pin using 26 nodes and 42 conductors. Run time for each transient analysis is approximately one minute of central processor time on the NOS operating system.

25579 **(WAPD-TM—1550) BREED: a CDC-7600 computer program for the automation of breeder reactor design analysis (LWBR Development Program).** Candelore, N.R.; Maher, C.M. (Bettis Atomic Power Lab., West Mifflin, PA (USA)). Mar 1985. Contract AC11-76PN00014. 122p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85010327.

BREED is an executive CDC-7600 program which was developed to facilitate the sequence of calculations and movement of data through a prescribed series of breeder reactor design computer programs in an uninterrupted single-job mode. It provides the capability to interface different application programs into a single computer run to provide a complete design function. The automation that can be achieved as a result of using BREED significantly reduces not only the time required for data preparation and hand transfer of data, but also the time required to complete an iteration of the total design effort. Data processing within a technical discipline and data transfer between technical disciplines can be accommodated. The input/output data processing is achieved with BREED by using a set of simple, easily understood user commands, usually short descriptive words, which the user inserts in his input deck. The input deck completely identifies and controls the calculational sequence needed to produce a desired end product. This report has been prepared to provide instructional material on the use of BREED and its user-oriented procedures to facilitate computer automation of design calculations.

2106 Power Reactors, Auxiliary, Mobile, Package, And Transportable

REFER ALSO TO CITATION(S) 25798

25580 **(ESG-DOE—13413) Power plant system assessment. Final report. SP-100 Program.** Anderson, R.V.; Atkins, D.F.; Bost, D.S.; Berman, B.; Clinger, D.A.; Determan, W.R.; Drucker, G.S.; Glasgow, L.E.; Hartung, J.A.; Harty, R.B. (Rockwell International Corp., Canoga Park, CA (USA). Energy Systems Group). 31 Oct 1983. Contract AT03-82SF11687. 357p. NTIS, PC A16/MF A01; 1; GPO Dep. File Number DE85009136.

The purpose of this assessment was to provide system-level insights into 100-kWe-class space reactor electric systems. Using these insights, Rockwell was to select and perform conceptual design studies on a "most attractive" system that met the preliminary design goals and requirements of the SP-100 Program. About 4 of the 6 months were used in the selection process. The remaining 2 months were used for the system conceptual design studies. Rockwell completed these studies at the end of FY 1983. This report summarizes the results of the power plant system assessment and describes our choice for the most attractive system - the Rockwell SR-100G System (Space Reactor, 100 kWe, Growth) - a lithium-cooled UN-fueled fast reactor/Brayton turboelectric converter system.

25581 **(LA-UR—85-1237) Performance characteristics of gravity-assisted, potassium heat pipes.** Prenger, F.C.; Keddy, E.S.; Sena, J.T. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 5p. (CONF-850607—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010717.

From AIAA thermophysics conference; Williamsburg, VA, USA (18 Jun 1985).

Experiments with potassium-stainless steel gravity-assisted heat pipes were performed. Performance limitations due to entrainment or flooding of the liquid return flow are compared with analytical model predictions. The effect of heated pool height was investigated and problems with surface wetting are discussed. A comparison between entrainment limits for smooth-walled and textured-walled heat pipes was made and a minimum internal surface texturing depth is suggested.

2107 Regulation And Licensing

REFER ALSO TO CITATION(S) 25366, 25613, 25632, 25633, 25634, 25635

25582 **(NUREG—0020-Vol.9-No.2) Licensed operating reactors. Status summary report, data as of January 31, 1985. Volume 9, No. 2.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Resource Management). Mar 1985. 422p. NTIS, PC A18/MF A01 - GPO. File Number TI85901303.

The US Nuclear Regulatory Commission's monthly Licensed Operating Reactors Status Summary Report provides data on the operation of nuclear units as timely and accurately as possible. This information is collected by the Office of Resource Management, from the Headquarters Staff of NRC's Office of Inspection and Enforcement, from NRC's Regional Offices, and from utilities. This report is divided into three sections: the first contains monthly highlights and statistics for commercial operating units, and errata from previously reported data; the second is a compilation of detailed information on each unit, provided by NRC Regional Offices, IE Headquarters and the Utilities; and the third section is an appendix for miscellaneous information such as spent fuel storage capability, reactor years of experience and non-power reactors in the United States.

25583 **(NUREG—0540-Vol.7-No.2) Title List of Documents Made Publicly Available, February 1-28, 1985. Volume 7, No. 2.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Technical Information and Document Control). 1985. 707p. NTIS, PC A99/MF A01 - GPO. File Number TI85901413.

The Title List of Documents Made Publicly Available is a monthly publication. It contains descriptions of the information received and generated by the US Nuclear Regulatory Commission (NRC) in February 1985. This information includes (1) docketed material associated with civilian nuclear power plants and other uses of radioactive materials and (2) nondocketed material received and generated by NRC pertinent to its role as a regulatory agency. As used here, docketed does not refer to Court dockets; it refers to the system by which NRC maintains its regulatory records. This series of documents is indexed by a Personal Author Index, a Corporate Source Index, and a Report Number Index.

25584 **(NUREG—0540-Vol.7-No.3) Title List of Documents Made Publicly Available, March 1-31, 1985. Volume 7, No. 3.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Technical Information and Document Control). Mar 1985. 426p. NTIS, PC A19/MF A01 - GPO. File Number TI85901414.

The Title List of Documents Made Publicly Available is a monthly publication. It contains descriptions of the information received and generated by the US Nuclear Regulatory Commission (NRC) in March 1984. This information includes: (1) docketed material associated with civilian nuclear power plants and other uses of radioactive materials; and (2) nondocketed material received and generated by NRC pertinent to its role as a regulatory agency. As used here, docketed does not refer to Court dockets; it refers to the system by which NRC maintains its regulatory records. This series of documents is indexed by a Personal Author Index, a Corporate Source Index, and a Report Number Index.

25585 **(NUREG—0748-Vol.5-No.2) Operating reactors licensing actions summary. Volume 5, No. 2.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Resource Management). Apr 1985. 385p. NTIS, PC A17/MF A01 - GPO. File Number TI85901375.

The Operating Reactors Licensing Actions Summary is designed to provide the management of the Nuclear Regulatory Commission (NRC) with an overview of licensing actions dealing with operating power and nonpower reactors. These reports utilize data collected from the Division of Licensing in the Office of Nuclear Reactor Regulation and are prepared by the Office of Resource Management. This summary report is published primarily for internal NRC use in managing the Operating Reactors Licensing Actions Program.

25586 **(ORNL/LMR/SP—85/3) Liquid Metal Reactor Programs: safeguards and program assurance. Technical progress report, Mar 1985.** Cooper, W.L. Jr. (Oak Ridge National Lab., TN (USA)). 19 Apr 1985. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010621.

Information is presented concerning activities related to the nuclear standards programs and the application of standards in DOE-funded nuclear energy programs.

2108 Economics

REFER ALSO TO CITATION(S) 25291, 25567

25587 **(NUREG/CR—4139) Mailed survey: a technique for obtaining feedback from operations personnel.** McGuire, M.V.; Walsh, M.E.; Morisseau, D.S. (Battelle Human Affairs Research Center, Seattle, WA (USA); Pacific Northwest Labs., Richland, WA (USA)). May 1985. Contract AC06-76RL01830. 87p. (PNL—5381; BHARC—400/84/028). NTIS, PC A05/MF A01 - GPO $4.50. File Number TI85011202.

This report describes a mailed survey of operations personnel at a sample of commercial nuclear power plants. The survey was conducted for the US Nuclear Regulatory Commission (NRC) as part of the Operator Feedback Project. The survey sought to collect information on topics of concern to the NRC and to assess the feasibility of a mailed survey as an information collection mechanism. Participants in the survey were 520 personnel at 26 nuclear power plants representing all five NRC regions. The individual participants completed and returned by mail a ten-page questionnaire. This contained questions about operations crew practices, including work and shift schedules, operations shift crew staffing, the shift technical advisor position, respondents' own backgrounds, the questionnaire, and other information-collection techniques. Results of the survey offer some insight on operations crew practices at the plants participating in the survey. Survey results also suggest that the mailed survey is an information-collection technique that can be used effectively to obtain feedback for the NRC from operations personnel.

22 NUCLEAR REACTOR TECHNOLOGY

2201 Theory And Calculation

REFER ALSO TO CITATION(S) 26420

25588 **(DOE/ER/10275—1A, pp 2, Paper 6) Describing function theory and application to problems in nuclear engineering.** Nassersharif, B. (Oregon State Univ., Corvallis). 1982. NTIS, PC A03/MF A01. File Number DE83004080. (CONF-820359—Absts.).

From Western regional American Nuclear Society student conference; Corvallis, OR, USA (28 Mar 1982).

A describing function treatment of the problem of nonlinear transient heat conduction in a solid cylindrical reactor fuel pin has been made by Guidotti. [illegible] problem for an annular fuel pellet has been performed by [illegible]. This was followed by a comparison of a finite element transient heat transfer code (COYOTE) and a computer code based on describing functions (DFTEMP). For a particular calculation, an improvement by a factor of approximately 40 was achieved by the describing function method over the finite element method in terms of decreased computational times. A generalized method for treatment of three dimensional nonlinear transient problems has been developed in this work. The convergence and initialization of this method needs further study and will be developed in continuation of this work. The development of describing functions for the heat conduction problem proved to be nontrivial exercise. However, the initial indications are that describing functions may have considerable promise for this type of calculation. Finite element and finite difference methods are the traditional approach to treat neutronic, thermal, and mechanical problems involving partial differential equations. However, because of the analytical nature of the describing function method, it is possible to not only realize a notable reduction in computational times but to avoid singularities and discontinuous behavior which can also occur in numerical analysis of various classes of physical problems.

25589 (DOE/ER/10275—1A, pp 3, Paper 7) **Quantitative characterization of representative two-phase flow.** Dailey, D.J. (Univ. of Washington). 1982. NTIS, PC A03/MF A01. File Number DE83004080. (CONF-820359—Absts.).

From Western regional American Nuclear Society student conference; Corvallis, OR, USA (28 Mar 1982).

25590 (DOE/ER/10275—1A, pp 2, Paper 10) **Integral transport theory boundary condition for close-packed lattices.** Sterbentz, J. (Oregon State Univ., Corvallis). 1982. NTIS, PC A03/MF A01. File Number DE83004080. (CONF-820359—Absts.).

From Western regional American Nuclear Society student conference; Corvallis, OR, USA (28 Mar 1982).

25591 **(JAPFNR—779) Radiation flux distribution calculation code system of the three-dimensional albedo Monte Carlo method.** Kawai, Masayoshi; Yamauchi, Michinori; Hayashida, Yoshihisa; Aratomei, Jiro. (Nippon Atomic Industry Group Co. Ltd., Tokyo; Toshiba Corp., Tokyo (Japan). Principal Office). [1985]. Translation of NAIG-KH-1878. 130p. NTIS (US Sales Only), PC A07/MF A01. File Number DE85900473.

The radiation flux code system, MORSE-ALB, based on the three-dimensional albedo Monte Carlo method, was developed in order to make it possible to more effectively conduct radiation streaming calculations for the void section of the nuclear reactor. In the present code system, the radiation distribution is calculated using the albedo Monte Carlo method, but it is also possible to calculate the reflection rate, which needs to be evaluated, by a calculation that combines the Sn-Monte Carlo method and the Monte Carlo-Monte Carlo method, or by combining the Monte Carlo calculation and the auxiliary Monte Carlo (or Sn) calculation. This code system has the MORSE-ALB code of the Monte Carlo calculation code, DOMINO-N, which is used for the coupling calculation of the Sn-Monte Carlo method, or the Monte Carlo-Monte Carlo method, a detector response calculation code RESPNS, which uses a combination of neutron flux and auxiliary flux, and furthermore, a one-dimensional transport code SLDN-SL3 (Invariant Imbedding method) as the differential albedo data formation code, and the ANISN-T (Sn method). By adding the two-dimensional albedo Sn code, DOT-ALB, to this, the kernel of the shielding calculation code system of this company is formed. The present report constitutes a manual for the MORSE and DOMINO-N codes, which contain RESPNS, and for SLDN and ANISN-T, which are used as the differential albedo data formation code, and it expains the characteristics and input and output formats of the code.

2202 Components And Accessories

25592 **(EPRI-NP—3927) Evaluation of a moisture removal device for turbine steam piping. Final report.** Anderson, R.E.; Draper, K.L.; Kadlec, R.A.; Stoudt, R.A. (Gilbert Associates, Inc., Reading, PA (USA)). Apr 1985. 115p. Research Reports Center, P.O. Box 50490, Palo alto, CA 94303. File Number TI85920584.

Moisture-induced erosion and corrosion of nuclear power plant steam pipes is a significant and costly maintenance problem. By removing moisture from steam leaving the high-pressure tur-

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bines, high-velocity moisture separators can minimize this damage in a vulnerable system and improve plant thermal performance.

25593 **(NUREG/CR—4015) Effect of stainless steel weld overlay cladding on the structural integrity of flawed steel plates in bending. Series 1.** Corwin, W.R.; Robinson, G.C.; Nanstad, R.K.; Merkle, J.G.; Berggren, R.G.; Goodwin, G.M.; Swain, R.L.; Owings, T.D. (Oak Ridge National Lab., TN (USA)). Apr 1985. Contract AC05-84OR21400. 100p. (ORNL/TM—9390). NTIS, PC A05/MF A01 - GPO. File Number TI85010349.

The Heavy-Section Steel Technology (HSST) Stainless Steel Cladding Evaluations were undertaken to study the interaction of stainless steel cladding on the inside surface of a reactor pressure vessel with flaws initiating and propagating in base metal. With the more recent focus of safety studies on overcooling type transients, for which the behavior of small flaws is important, stainless steel cladding may have a key role in controlling the propagation and/or arrest of propagating flaws. A complicating factor in understanding the role of stainless steel cladding in this setting is the scarcity of data on its fracture toughness as a function of radiation dose and the fabrication process. The initial phase of the HSST evaluations addresses this question by testing the response of 51-mm-thick flawed plates clad with single-wire, submerged-arc weld overlays of different toughness levels. The tests completed indicate that cladding of moderate toughness had a limited ability to enhance the structural arrest toughness of a beam in bending. The specimen design and fabrication techniques employed for this first completed series of tests resulted in flaw and specimen configurations that prevented adequate control of the stress state at pop-in of the hydrogen-charged electron-beam welds. As a result, analyses of the tests by two approximate techniques and by the ORMGEN-ADINA-ORVIRT finite-element programs were not completely consistent.

2204 Control Systems

25594 **(CONF-850410—30) Simulation and operation of the EBR-II automatic control rod drive system.** Lehto, W.K.; Larson, H.A.; Dean, E.M.; Christensen, L.J. (Argonne National Lab., Idaho Falls, ID (USA)). 1985. Contract W-31-109-ENG-38. 24p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010262.

From ANS/ENS fast reactor safety meeting; Knoxville, TN, USA (21 Apr 1985).

An automatic control rod drive system (ACRDS) installed at EBR-II produces shaped power transients from 40% to full reactor power at a linear ramp rate of 4 MWt/s. A digital computer and modified control-rod-drive provides this capability. Simulation and analysis of ACRDS experiments establish the safety envelope for reactor transient operation. Tailored transients are required as part of USDOE Operational Reliability Testing program for prototypic fast reactor fuel cladding breach behavior studies. After initial EBR-II driver fuel testing and system checkout, test subassemblies were subjected to both slow and fast transients. In additions, the ACRDS is used for steady-state operation and will be qualified to control power ascent from initial critical to full power.

25595 **(INFO—0084) Human factors needs assessment and planning study.** Price, H.E.; Van Cott, H.P. (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Jun 1982. 100p. NTIS (US Sales Only), PC A05/MF A01. File Number DE85700607.

A study was done to assess the need for human factors research, development, and regulatory action in the Atomic Energy Control Board. Further study or development in nine human factors areas is proposed. The urgency, schedule, and resources judged to be necessary for the proposed efforts are estimated. Special emphasis is placed on the need for task analysis information, for the evaluation of control room and maintenance human engineering, and for the development of an improved human error reporting system.

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25596 **(NUREG/CR—4191) Survey of licensee control room habitability practices.** Boland, J.F.; Brookshire, R.L.; Danielson, W.F.; Driscoll, J.W.; Graham, E.D.; McConnell, R.J.; Thompson, V.N. (Argonne National Lab., Idaho Falls, ID (USA)). Apr 1985. Contract W-31-109-ENG-38. 228p. (ANL—85-13). NTIS, PC A11/MF A01 - GPO $6.50. File Number TI85011295.

This document presents the results of a survey of Licensee control-room-habitability practices. The survey is part of a comprehensive program plan instituted in August 1983 by the NRC to respond to ongoing questions from the Advisory Committee on Reactor Safeguards (ACRS). The emphasis of this survey was to determine by field review the control-room habitability practices at three different plants, one of which is still under construction and scheduled to receive an operating license in 1986. The other two plants are currently operating, having received operating licenses in the mid-1970's and early 1980's. The major finding of this survey is that despite the fact that the latest control-room-habitability systems have become larger and more complex than earlier systems surveyed, the latest systems do not appear to be functionally superior. The major recommendation of this report is to consolidate into a single NRC document, based upon a comprehensive systems engineering approach, the pertinent criteria for control-room-habitability design.

2205 Environmental Aspects

25597 **(INFO—0088) Tornadoes in Canada for the period 1950 to 1979.** Newark, M.J. (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Jun 1981. 98p. NTIS (US Sales Only), PC A05/MF A01. File Number DE85700598.

This report has attempted to arrive at a set of quantitative conclusions concerning the physical characteristics of tornadoes from what is basically a set of qualitative data. The task was composed of a number of steps: a) finding the data in the first place, b) defining the terms and equations to be used in the study, c) devising a method of dealing with the errors and inconsistencies in the data, d) encoding it into a quantitative form, e) computerizing the encoded data for ease of sorting and calculation, and f) analyzing the result. The results of the study give details concerning the physical dimensions of tornado damage; national maps of tornado incidence and risk; probability of tornado damage in selected cities; diurnal and seasonal frequencies as well as frequencies of travel direction and F-scale number; length of tornado season. An analysis has been made of the distribution of damage length, width and area in order to find whether or not correlations exist among them, and whether or not they can be described in a mathematical fashion. No correlations were found, and although the distributions of these dimensions superficially resembled a log normal curve, this result failed to be statistically significant.

25598 **(OH—82-103-K) Attached algal community near Pickering GS: (II). Factors influencing algal standing crop.** McKinley, S.R. (Ontario Hydro Research Lab., Toronto (Canada)). 4 Jun 1982. 26p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85700599.

Environmental parameters correlated with attached algal standing crop are investigated in this report. Three groups were recognized on the basis of standing crop levels and seasonal standing crop patterns. Factors which appeared to influence the separation among the three groups were substrate size and water temperature. Standing crop levels among the discharge transects, intake and areas outside the station were found to be correlated with a combination of parameters. Standing crop levels outside the station were inversely correlated with wind speed but positively correlated with substrate particle size and depth. Algal standing crop at the intake also was inversely correlated with wind speed. Differences in standing crop levels between the intake and areas outside the station may have been attributed to substrate particle size. Low standing crop level among the discharge transects may have been attributed to higher current velocities and periodically to high water temperature.

25599 **(OH—82-311-K) Attached algae community near Pickering GS: III. Relationship between attached algae and macroinvertebrates.** McKinley, S.R. (Ontario Hydro Research Lab., Toronto (Canada)). 16 Jul 1982. 46p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85700600.

The relationship between attached algae and macro-invertebrates in the nearshore zone of Lake Ontario was investigated in the vicinity of the Pickering 'A' NGS. Measures of faunal density, richness, evenness, and biomass were generally higher from areas which supported attached algae. Gammarus fasciatus, Cricotopus bicinctus, Dicrotendipes spp., Orthocladius obumbratus, Cladotanytarsus spp., Orthocladius spp., and Parakiefferiella spp., were significantly correlated with algal standing crop. All of the above dominant invertebrates ingested epiphytes associated with Cladophora glomerata. Attempts to explain the distribution of the zoobenthic assemblages using the physical/biological characteristics of the study area indicated algal cover, substrate size, wind velocity and water temperature were most important.

2206 Research, Test, And Experimental Reactors

REFER ALSO TO CITATION(S) 25594, 25611, 25636, 26046, 26434

25600 **(NUREG/CR—3872) Data acquisition and control of the HSST Series V irradiation experiment at the ORR.** Miller, L.F.; Hobbs, R.W. (Oak Ridge National Lab., TN (USA)). Mar 1985. Contract AC05-84OR21400. 92p. (ORNL/TM—9253). NTIS, PC A05/MF A01 - GPO. File Number TI85007338.

Documentation relative to the computer system hardware and supporting real-time application support software is included in this report. Data flow for intertask communication is described in relation to major computer system components. A complete listing of command files and codes for all tasks is provided in order to facilitate making changes for experiment modification. The general features of the temperature control algorithm and the software (K1CTCL.FTN) for its implementation are presented. The software [which is part of an overall temperature control system for the HSST Series V Irradiation Experiments being conducted at the Oak Ridge Research Reactor (ORR)] determines the required amount of electrical heat input to the irradiation capsules based on temperature errors from thermocouples located within the capsules. Heat transfer considerations relative to modeling and controller gains are discussed, and results that illustrate the transient response and steady-state temperature distributions obtained in the capsules are presented.

2209 Reactor Safety

REFER ALSO TO CITATION(S) 25595, 26086, 26435

25601 **(BNL-NUREG—28060) Sensitivity of risk parameters for a PWR.** Samanta, P.; Hall, R.E.; Kerr, W. (Brookhaven National Lab., Upton, NY (USA); Michigan Univ., Ann Arbor (USA). Dept. of Nuclear Engineering). 1980. Contract AC02-76CH00016. 6p. (CONF-801107—78). NTIS, PC A02/MF A01. File Number TI85004756.

From ANS international conference; Washington, DC, USA (17 Nov 1980).

Sensitivities of the risk parameters, emergency safety system unavailabilities, accident sequence probabilities, release category probabilities and core melt probability were investigated for changes in the human error rates within the general methodological framework of the Reactor Safety Study for a Pressurized Water Reactor (PWR). Impact of individual human errors were assessed both in terms of their structural importance to core melt and reliability importance on core melt probability. The Human Error Sensitivity Assessment of a PWR (HESAP) computer code was written for the purpose of this study.

25602 **(BNL-NUREG—28061) Human errors rates: quantification method from nuclear experience and data.** Luckas, W.J. Jr.; Hall, R.E. (Brookhaven National Lab., Upton, NY (USA)). 1980. Contract AC02-76CH00016. 5p. (CONF-801107—79). NTIS, PC A02/MF A01. File Number TI85004731.

From ANS international conference; Washington, DC, USA (17 Nov 1980).

This paper reports on a practical method of quantifying human errors made in conjunction with testing, maintaining, and operating select important components in reactor safety systems of licensed nuclear power plants. This quantification of human error is measured in terms of human error rate (HER) namely the ratio of the number of human errors (of a specified type) to the number of opportunities for those particular errors. The human error rates generated in this work provide a very useful broad basis of comparison for appropriate derived and/or best judgment human error rate estimates which have been used in WASH-1400, and also can provide input to bounding type risk assessments. The number of human errors have been extracted from a computer-based data file of one-line description summary interpretations of Licensee Event Reports for interfacing with manual and remotely operated valves and pumps over a three year period ending in 1978. The systems evaluated are the reactor safety systems for 23 BWRs and for 41 PWRs.

25603 **(BNL-NUREG—28972) Analysis of boron injection transients in pressurized water reactors at natural circulation conditions.** Perkins, K.R.; Bari, R.A.; Cazzoli, E.G. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 5p. (CONF-810606—20). NTIS, PC A02/MF A01. File Number TI85004727.

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

The objective of this paper is to analyze boron injection transients at natural circulation conditions in anticipation of preoperational testing in commercial Pressurized Water Reactors (PWRs). The results of the analysis are expected to aid in identifying important phenomena affecting the mixing process and to help to define the measurements needed to assess the results of such tests.

25604 **(BNL-NUREG—28999) Effect of pressure and flow on the BWR rod drop accident.** Cheng, H.S.; Lu, M.S.; Diamond, D.J. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 5p. (CONF-810606—110). NTIS, PC A02/MF A01 - GPO. File Number TI85004758.

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

This paper has calculated the pressure rise and inlet flow variation during a rod drop accident. Results show that the effect of these parameters tends to increase the calculated peak fuel enthalpy. Nevertheless, it is clear that the moderator feedback still has a strong inherent mitigating effect on the transient, and the effect of pressure and flow on the RDA is, in this sense, of second order.

25605 **(BNL-NUREG—35926) Contributions from moderate frequency transient initiators in a BWR PRA.** Ilberg, D.; Hanan, N.; Shiu, K. (Brookhaven National Lab., Upton, NY (USA)). 1985. Contract AC02-76CH00016. 6p. (CONF-850610—20). NTIS, PC A02/MF A01 - GPO. File Number TI85007926.

From Annual meeting of the American Nuclear Society; Boston, MA, USA (9 Jun 1985).

Transients are significant contributors to the core damage frequency in Boiling Water Reactors (BWR). The main contribution comes from transients with frequency of occurrence in the range of 3 to 100 events during plant lifetime (30 to 40 years). Examples of these transients are turbine trip, loss of condenser, and inadvertently open relief valve (IORV). Reviews by BNL of BRW PRAs appear to indicate that moderate frequency transients also could significantly contribute to the total core damage frequency. Moderate frequency transients are those events having frequencies ranging from 0.1 to 3 times per plant lifetime. The present study discusses some of these events and identifies conditions that make their contribution to plant core damage frequency significant.

25606 **(BNL-NUREG—36009) Analysis of a SBLOCA initiated by an ATWS event.** Pu, J.; Diamond, D.J.; Shier, W.G. (Brookhaven National Lab., Upton, NY (USA)). 1985. Contract AC02-76CH00016. 7p. (CONF-850646—1). NTIS, PC A02/MF A01 - GPO. File Number TI85007483.

From 2. international specialists meeting on small break LOCA analyses in LWRs; Pisa, Italy (24 Jun 1985).

The response of a four-loop Westinghouse pressurized water reactor to SBLOCAs initiated as a result of an anticipated transient without scram (ATWS) has been analyzed using the RELAP5 computer code. The ATWS is initiated by a loss-of-feedwater, and the small breaks were due to either one or three stuck-open safety valves or reactor coolant pump seal failure. For the cases analyzed, the results show that a LOF-ATWS followed by a SBLOCA does not have more safety significance than that found when each accident is analyzed independently of one another.

25607 **(BNL-NUREG—36035) Gas bubbling-enhanced film boiling of Freon-11 on liquid metal pools.** Greene, G.A. (Brookhaven National Lab., Upton, NY (USA)). 1985. Contract AC02-76CH00016. 7p. (CONF-850610—19). NTIS, PC A02/MF A01 - GPO. File Number TI85007924.

From Annual meeting of the American Nuclear Society; Boston, MA, USA (9 Jun 1985).

In the analysis of severe core damage accidents in LWRs, a major driving force which must be considered in evaluating containment loading and fission product transport is the ex-vessel interaction between molten core debris and structural concrete. Two computer codes have been developed for this purpose, the CORCON-MOD2 model of ex-vessel, core concrete interactions and the VANESA model for aerosol generation and fission product release as a result of molten core-concrete interactions. Under a wide spectrum of reactor designs and accident sequences, it is possible for water to come into contact with the molten core debris and form a coolant pool overlying the core debris which is attacking the concrete. As the concrete decomposes, noncondensable gases are released, which bubble through the melt and across the boiling interface, affecting the liquid-liquid boiling process. Currently, the CORCON code includes the classical Berenson model for film boiling over a horizontal flat plate for this phenomenon. The objectives of this activity are to investigate the influence of transverse noncondensable gas flux on the magnitude of the stable liquid-liquid film boiling heat flux and develop a gas flux-enhanced, liquid-liquid film boiling model for incorporation into the CORCON-MOD2 computer code to replace or modify the Berenson model.

25608 **(CONF-810333—1) Fission product release mechanisms and pathways.** Malinauskas, A.P. (Oak Ridge National Lab., TN (USA)). 1981. Contract AC05-84OR21400. 30p. NTIS, PC A03/MF A01. File Number TI85004523.

From Faculty institute on light water reactor safety-degraded core cooling; Argonne, IL, USA (16 Mar 1981).

It is axiomatic that the severity of a nuclear reactor accident is determined by the extent of radioactivity escape which results. The main focus of site safety analyses is thus on fission product release and transport. Of all the processes involved, fission product escape from the fuel-cladding region into the primary coolant circuit is perhaps the most simple to describe; even so, it is an extremely complex function of the time/temperature history of the fuel-cladding system during an accident, since many mechanisms for release are involved. Depending upon the particular fission product species, these release mechanisms range from simple gaseous expansion processes at low temperatures to evaporation-condensation processes (aerosol formation) over molten fuel. Because of these complexities, it is convenient to subdivide the time/temperature sequence of an accident into more or less discrete phases over which specific release mechanisms dominate. Four such phases are the periods of (1) gap release, (2) meltdown release, (3) vaporization, and (4) oxidation release. This approach simplifies the problem considerably, although some loss of uniformity results. The methodology applies to BWR and PWR reactors with appropriate adaptations.

25609 **(CONF-810803—3) PWR representative behavior during a LOCA.** Allison, C.M. (Idaho National Engineering Lab., Idaho Falls (USA)). 1981. Contract AC07-76ID01570. 7p. NTIS, PC A02/MF A01. File Number TI85004742.

From Topical meeting on reactor safety aspects of fuel behavior; Sun Valley, ID, USA (2 Aug 1981).

To date, there has been substantial analytical and experimental effort to define the margins between design basis loss-of-coolant accident (LOCA) behavior and regulatory limits on maximum fuel rod cladding temperature and deformation. As a result, there is extensive documentation on the modeling of fuel rod behavior in test reactors and design basis LOCA's. However, modeling of that behavior using representative, non-conservative, operating histories is not nearly as well documented in the public literature. Therefore, the objective of this paper is (a) to present calculations of LOCA induced behavior for Pressurized Water Reactor (PWR) core representative fuel rods, and (b) to discuss the variability in those calculations given the variability in fuel rod condition at the initiation of the LOCA. This analysis was limited to the study of changes in fuel rod behavior due to different power operating histories. The other two important parameters which affect that behavior, initial fuel rod design and LOCA coolant conditions were held invarient for all of the representative rods analyzed.

25610 **(CONF-811042—10) PWR pressure vessel integrity during overcooling accidents.** Cheverton, R.D. (Oak Ridge National Lab., TN (USA)). 1981. Contract AC05-84OR21400. 3p. NTIS, PC A02/MF A01. File Number TI85004515.

From 9. water reactor safety research information meeting; Washington, DC, USA (26 Oct 1981).

Pressurized water reactors are susceptible to certain types of hypothetical accidents that under some circumstances, including operation of the reactor beyond a critical time in its life, could result in failure of the pressure vessel as a result of propagation of crack-like defects in the vessel wall. The accidents of concern are those that result in thermal shock to the vessel while the vessel is subjected to internal pressure. Such accidents, referred to as pressurized thermal shock or overcooling accidents (OCA), include a steamline break, small-break LOCA, turbine trip followed by stuck-open bypass valves, the 1978 Rancho Seco and the TMI accidents and many other postulated and actual accidents. The source of cold water for the thermal shock is either emergency core coolant or the normal primary-system coolant. ORNL performed fracture-mechanics calculations for a steamline break in 1978 and for a turbine-trip case in 1980 and concluded on the basis of the results that many more such calculations would be required. To meet the expected demand in a realistic way a computer code, OCA-I, was developed that accepts primary-system temperature and pressure transients as input and then performs one-dimensional thermal and stress analyses for the wall and a corresponding fracture-mechanics analysis for a long axial flaw. The code is briefly described, and its use in both generic and specific plant analyses is discussed.

25611 **(CONF-850406—5) Source term experiments project (STEP): aerosol characterization system.** Schlenger, B.J.; Dunn, P.F. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010248.

From International symposium and workshop on particulate and multi-phase processes and the 16th annual meeting of the Fine Particle Society; Miami Beach, FL, USA (22 Apr 1985).

A series of four experiments is being conducted at Argonne National Laboratory's TREAT Reactor. They have been designed to provide some of the necessary data regarding magnitude and release rates of fission products from degraded fuel pins, physical and chemical characteristics of released fission products, and aerosol formation and transport phenomena. These are in-pile experiments, whereby the test fuel is heated by neutron induced fission and subsequent clad oxidation in steam environments that simulate as closely as practical predicted reactor accident conditions. The test sequences cover a range of pressure and fuel heatup rate, and include the effect of Ag/In/Cd control rod material.

25612 **(CONF-850410—24) TRANSIT-HYDRO transition phase accident analysis code: an overview and recent improvements.** Wigeland, R.A.; Briggs, L.L. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 5p. NTIS, PC A02/MF A01. File Number DE85005043.

From ANS/ENS fast reactor safety meeting; Knoxville, TN, USA (21 Apr 1985).

The TRANSIT-HYDRO computer code is being developed to provide a tool for assessing the consequences of transition phase events in a hypothetical core disruptive accident in an LMFBR. The TRANSIT-HYDRO code incorporates detailed geometric modeling on a subassembly-by-subassembly basis and detailed modeling of reactor material behavior and thermal and hydrodynamic phenomena. The purpose of this summary is to give a brief overview of the code and to describe recent improvements to the code, particularly the addition of new phenomenological models. Sample results with these new models are also described. The TRANSIT-HYDRO code is constructed on a modular basis, which allows models to be added or changed readily. In this summary, the emphasis is on the disrupted subassembly module which is used once the fuel pin inside the subassembly starts to disrupt.

25613 **(CONF-850610—10-Summ.) Method for developing cost estimates for generic regulatory requirements.** (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85006215.

From Annual meeting of the American Nuclear Society; Boston, MA, USA (9 Jun 1985).

The NRC has established a practice of performing regulatory analyses, reflecting costs as well as benefits, of proposed new or revised generic requirements. A method had been developed to assist the NRC in preparing the types of cost estimates required for this purpose and for assigning priorities in the resolution of generic safety issues. The cost of a generic requirement is defined as the net present value of total lifetime cost incurred by the public, industry, and government in implementing the requirement for all affected plants. The method described here is for commercial light-water-reactor power plants. Estimating the cost for a generic requirement involves several steps: (1) identifying the activities that must be carried out to fully implement the requirement, (2) defining the work packages associated with the major activities, (3) identifying the individual elements of cost for each work package, (4) estimating the magnitude of each cost element, (5) aggregating individual plant costs over the plant lifetime, and (6) aggregating all plant costs and generic costs to produce a total, national, present value of lifetime cost for the requirement. The method developed addresses all six steps. In this paper, we discuss on the first three.

25614 **(CONF-850610—27) Analysis of a PWR downcomer and lower plenum under asymmetric loop flow conditions.** Lyczkowski, R.W.; Kim, J.H.; Fohs, H.P. (Argonne National Lab., IL (USA); Electric Power Research Inst., Palo Alto, CA (USA); Commonwealth Edison Co., Chicago, IL (USA)). 1985. Contract W-31-109-ENG-38. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010296.

From Annual meeting of the American Nuclear Society; Boston, MA, USA (9 Jun 1985).

Certain postulated transient conditions in a PWR may cause the flow rate and the temperature of the coolant entering the core from one of the cold leg loops to differ significantly from those in the other loops. When the flow rate and/or temperature of the loops are not balanced, the resulting thermal mixing at the core inlet will become nonuniform, and the assumption of perfect mixing is not only unwarranted, but may lead to an erroneous prediction of radial power distribution. The objective of this paper is to describe the results of the three-dimensional steady-state calculations for the analysis of thermal mixing in a PWR. The specific case chosen for the present study is one of the tests conducted in the Oconee-1 PWR. Those tests were conducted to determine the extent of downcomer and lower plenum mixing in response to various temperature differences or flow imbalances between the two coolant loops. These tests were performed specifically to obtain coolant temperature profiles at the core inlet, core outlet, and various axial locations in the core under imposed offset loop conditions. The calculations were performed using the COMMIX-1A computer code.

25615 **(CONF-850670—13) Seismic analysis of liquid-filled tanks with an eccentric core barrel.** Liu, W.K.; Gvildys, J. (Argonne National Lab., IL (USA); Northwestern Univ., Evanston, IL (USA). Dept. of Mechanical and Nuclear Engineering). 1985. Contract W-31-109-ENG-38. 13p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010249.

From ASME pressure vessel and piping division conference; New Orleans, LA, USA (24 Jun 1985).

The seismic analysis of fluid-coupled concentric cylindrical shells is reviewed. A coupled fluid-structure finite element method which considers the sloshing effect is then developed for the seismic analysis of liquid-filled systems with internal components. The theoretical development of the mixed finite element formulation is also included. The resulting fluid-structure interaction algorithm has been integrated into the computer code FLUSTR II and the seismic analysis of liquid-filled tanks with an eccentric core barrel is performed. Numerical results show the method yields accurate solutions with large increases in efficiency.

25616 **(CONF-850670—14) Analysis of seismic sloshing of reactor tanks considering submerged components and seismic isolation.** Ma, D.C.; Chang, Y.M. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010499.

From ASME pressure vessel and piping division conference; New Orleans, LA, USA (24 Jun 1985).

A study of the seismic sloshing response of a large pool-type reactor tank with several deck-mounted components is presented. The main objective of the study is to investigate the effects of internal components on the sloshing response and to determine the sloshing loads on the components. The study shows that the presence of internal components can significantly change the dynamic characteristics of the sloshing motion. The sloshing frequencies of a tank with internal components are considerably higher than those of a tank without internals. The higher sloshing frequencies reduce the sloshing wave height on the free surface but the dynamic pressures of the fluid are increased. The effects of seismic isolation on sloshing response are also presented.

25617 **(DOE/CL/98004—29) Sodium concrete reaction: structural considerations.** Freskakis, G.N. (Burns and Roe, Inc., Oradell, NJ (USA)). Sep 1984. Contract AC15-76CL98004. 25p. (CONF-840913—7). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85009031.

From Conference on structural engineering in operating nuclear facilities; Raleigh, NC, USA (10 Sep 1984).

An overview of the sodium concrete reaction phenomenon, with emphasis on structural considerations, is presented. Available test results for limestone, basalt, and magnetite concrete with various test article configurations are reviewed. Generally, tests indicate reaction is self limiting before all sodium is used. Uncertainties, however, concerning the mechanism for penetration of sodium into concrete have resulted in different theories about a reaction model. Structural behavior may be significant in the progression of the reaction due to thermal-structural-chemical interactions involving tensile cracking, compressive crushing, or general deterioration of concrete and the exposure of fresh concrete surfaces to react with sodium. Structural behavior of test articles and potential factors that could enhance the progression of the reaction are discussed.

25618 **(DOE/CL/98004—34) Behavior of reinforced concrete at elevated temperatures.** Freskakis, G.N. (Burns and Roe, Inc., Oradell, NJ (USA)). Sep 1984. Contract AC15-76CL98004. 34p. (CONF-840913—8). NTIS, PC A03/MF A01; GPO Dep. File Number DE85009032.

From Conference on structural engineering in operating nuclear facilities; Raleigh, NC, USA (10 Sep 1984).

A study is presented concerning the behavior of reinforced concrete sections at elevated temperatures. Material properties of concrete and reinforcing steel are discussed. Behavior studies are made by means of moment-curvature-axial force relationships. Particular attention is given to the load carrying capacity, thermal forces and moments, and deformation capacity. The effects on these properties of variations in the strength properties, the temperature

level and distribution, the amount of reinforcing steel, and limiting values of strains are considered.

25619 **(DOE/ID/12101—85) POP: a code for estimating populations around facilities with results for the INEL.** Burkhart, R.A.; Hoff, D.L. (USDOE Idaho Operations Office, Idaho Falls). Mar 1985. 78p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85010125.

This report describes the use of the POP computer program. POP calculates the population in each of 16 sectors in 10-mile radial increments out to 50 miles (80 km) from any selected location. Two other programs, PROMPT and POPTEST are also described. PROMPT assists the user in creating external files required for use with POP; POPTEST is used, along with other methods, to evaluate POP performance. Detailed instructions, program listings, and flow charts are included. These programs were developed by DOE at the Radiological and Environmental Sciences Laboratory (RESL) for use at the Idaho National Engineering Laboratory (INEL). However, they may have wider application both inside and outside the nuclear industry. The method of data collection used for the area of southeastern Idaho surrounding the INEL is described, and population estimates by square mile are presented for use with the program. Population distribution by sector, around each of nine major INEL facilities, are also presented.

25620 **(DOE/OR/21400—T115) ORNL projects for the NRC Office of Nuclear Regulatory Research. March 1985 monthly highlights.** Malinauskas, A.P.; Winslow, S.G. (Oak Ridge National Lab., TN (USA)). 24 Apr 1985. Contract AC05-84OR21400. 79p. NTIS, PC A05/MF A01 - GPO; GPO Dep. File Number TI85011057.

Highlights of technical progress during March 1985 are presented for ORNL research projects for the Office of Nuclear Regulatory Research. Areas covered include engineering technology, accident evaluation, risk analysis and operations, and radiation programs and earth sciences. (GHT)

25621 **(EGG-M—24384) TMI-2 Core Sample Acquisition and Examination Project status.** Sumpter, K.C. (EG and G Idaho, Inc., Idaho Falls (USA)). 1984. Contract AC07-76ID01570. 3p. (CONF-8410142—81). NTIS, PC A02/MF A01; GPO Dep. File Number DE85006378.

From 12. water reactor safety research information meeting; Gaithersburg, MD, USA (23 Oct 1984).

The TMI-2 Core Sample Acquisition and Examination (CSA and E) Project is part of the Data Acquisition (at TMI) and Core Activities (at INEL) Programs funded by the US Department of Energy. Composed of 17 separate tasks, the CSA and E is described in detail in the document entitled TMI-2 Core Examination Plan EGG-TMI-6169). To date, subsurface core debris samples, resistance thermal detectors, control rod leadscrews, a leadscrew support tube, makeup and purification system filters, and in situ documentation data have been obtained from TMI-2 and are being examined by various laboratories throughout the country. Other tasks listed in the aforementioned document are currently being developed. These tasks include examining fueled rod segments, core stratification samples, and distinct fuel assembly components. The sample acquisition work is listed in the GPU Nuclear/Bechtel document entitled In-Vessel Data Acquisition Technical Plan (TPO/TMI-117) which states the relationship between data acquisition tasks and the plant recovery program.

25622 **(EGG-SEMI—6827) Quick Look Report for Semiscale MOD-2C Test S-FS-2.** Boucher, T.J.; Chen, T.H. (EG and G Idaho, Inc., Idaho Falls (USA)). 22 Mar 1985. Contract AC07-76ID01570. 91p. NTIS, PC A05/MF A01 - GPO. File Number TI85011257.

Results of a preliminary analysis of the first test performed in the Semiscale MOD-2C Steam Generator Feedwater and Steam Line Break (FS) experiment series are presented. Test S-FS-2 simulated a pressurized water reactor transient initiated by a double-ended offset shear of a steam generator main steam line upstream of the flow restrictor. Initial conditions represented normal "hot-stand-by" operation. The transient included an initial 600-s period in which only automatic plant protection systems responded to the initiating event. This period was followed by a series of operator actions necessary to stabilize the plant at conditions required to allow a natural circulation cooldown. The test results provided a measured evaluation of the effectiveness of the automatic responses in minimizing primary system overcooling and operator actions in stabilizing the plant. Test data also provided a basis for comparison with other tests in the series of the effects of break size on primary overcooling and primary-to-secondary heat transfer. 57 figs., 3 tabs.

25623 **(EPRI-NP—3605-CCM-Vol.1) DATATRAN: a data base management and executive computer code system. Volume 1. Description and overview.** Kopp, H.J. (Technology Development of California, Inc., Santa Clara (USA)). Mar 1985. 54p. Research Reports Center, Box 50490, Palo Alto, CA 94303 $10.00. File Number TI85920586.

This report provides a description and overview of the DATATRAN computer code system. Emphasis is on its applicability to engineering and scientific problems as well as its overall design. This report includes a description of the system, data base and code linking examples, and a section on installation and maintenance.

25624 **(EPRI-NP—3941) Robot applications for nuclear power plant maintenance.** Bartholet, T.G. (Odetics, Inc., Anaheim, CA (USA)). Mar 1985. 96p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920565.

A new robot design may revolutionize nuclear power plant maintenance. Exceptional strength,a telescoping arm, agility over irregular surfaces and in crowded environments, and on-board computer control will make this working machine extremely versatile. Its application to maintenance tasks can save money and may reduce human exposure to radiation.

25625 **(GEND—049) TMI-2 Technical Information and Examination Program. 1984 annual report.** Hess, C.J. (ed.). (EG and G Idaho, Inc., Idaho Falls (USA)). Apr 1985. Contract AC07-76ID01570. 54p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85010614.

In 1984, the US Department of Energy's Technical Information and Examination Program entered its fifth year of research and development work at Three Mile Island Unit 2 (TMI-2) and at the Idaho National Engineering Laboratory and other supporting laboratories. The work concentrated on six major areas: waste immobilization, reactor evaluation, data acquisition, information and industry coordination, core activities, and EPICOR II and waste research and disposition.

25626 **(LA-UR—85-915) Loss-of-flow transient characterization in carbide-fueled LMFBRs.** Rothrock, R.B.; Morgan, M.M.; Baars, R.E.; Elson, J.S.; Wray, M.L. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 21p. (CONF-851007—5). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85009552.

From 3. international meeting on reactor thermal hydraulics; Newport, RI, USA (15 Oct 1985).

One of the benefits derived from the use of carbide fuel in advanced Liquid Metal Fast Breeder Reactors (LMFBRs) is a decreased vulnerability to certain accidents. This can be achieved through the combination of advanced fuel performance with the enhanced reactivity feedback effects and passive shutdown cooling systems characteristic of the current 'inherently safe' plant concepts. The calculated core response to an unprotected loss of flow (ULOF) accident has frequently been used as a benchmark test of these designs, and the advantages of a high-conductivity fuel in relation to this type of transient have been noted in previous analyses. To evaluate this benefit in carbide-fueled LMFBRs incorporating representative current plant design features, limited calculations have been made of a ULOF transient in a small ('modular') carbide-fueled LMFBR.

25627 **(LA-UR—85-1341) Review of the SIMMER-II analyses of liquid-metal-cooled fast breeder reactor core-disruptive accident fuel escape.** DeVault, G.P.; Bell, C.R. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 8p. (CONF-850410—37). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010803.

From ANS/ENS fast reactor safety meeting; Knoxville, TN, USA (21 Apr 1985).

Early fuel removal from the active core of a liquid-metal-cooled fast breeder reactor undergoing a core-disruptive accident may reduce the potential for large energetics resulting from recriticalities. This paper presents a review of analyses with the SIMMER-II computer program of the effectiveness of possible fuel escape paths. Where possible, how SIMMER-II compares with or is validated against experiments that simulated the escape paths also is discussed.

25628 **(LA-UR—85-1368) Response of steam-water mixtures to pressure transients.** Hull, L.M. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 11p. (CONF-850410—33). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010798.

From ANS/ENS fast reactor safety meeting; Knoxville, TN, USA (21 Apr 1985).

During the transition phase of a hypothetical core-disruptive accident in a liquid-metal fast breeder reactor, melting fuel-steel mixtures may begin to boil, resulting in a two-phase mixture of molten reactor fuel and steel vapor. Dispersal of this mixture by pressure transients may prevent recriticality of the fuel material. This paper describes the results of a series of experiments that investigated the response of two-phase mixtures to pressure transients. Simulant fluids (steam/water) were used in a transparent 10.2-cm-dia, 63.5-cm-long acrylic tube. The pressure transient was provided by releasing pressurized nitrogen from a supply tank. The data obtained are in the form of pressure-time records and high-speed movies. The varied parameters are initial void fraction (10% and 40%) and transient pressure magnitude (3.45 and 310 kPa).

25629 **(LA-UR—85-1374) SIMMER-II analysis of transition-phase experiments.** Wehner, T.R.; Bell, C.R. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 9p. (CONF-850410—34). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010782.

From ANS/ENS fast reactor safety meeting; Knoxville, TN, USA (21 Apr 1985).

Analyses of Los Alamos transition-phase experiments with the SIMMER-II computer code are reported. These transient boilup experiments simulated the recriticality-induced transient motion of a boiling pool of molten fuel, molten steel and steel vapor, within a subassembly duct in a liquid-metal fast breeder reactor during the transition phase of a core-disruptive accident. The two purposes of these experiments were to explore and reach a better understanding of fast reactor safety issues, and to provide data for SIMMER-II verification. Experimental data, consisting of four pressure traces and a high-speed movie, were recorded for four sets of initial conditions. For three of the four cases, SIMMER-II-calculated pressures compared reasonably well with the experimental pressures. After a modification to SIMMER-II's liquid-vapor drag correlation, the comparison for the fourth case was reasonable also. 12 refs., 4 figs.

25630 **(NUREG—0090-Vol.7-No.3) Report to Congress on abnormal occurrences, July-September 1984. Volume 7, No. 3.** (Nuclear Regulatory Commission, Washington, DC (USA). Office for Analysis and Evaluation of Operational Data). Apr 1985. 66p. NTIS, PC A04/MF A01 - GPO. File Number TI85901410.

For this report period, there were four abnormal occurrences at the nuclear power plants licensed to operate. These involved degraded isolation valves in emergency core cooling systems, degraded shutdown systems, a loss of offsite and onsite ac electrical power, and a refueling cavity water seal failure, respectively. There was one abnormal occurrence at a fuel cycle facility; the event involved degraded material access area barriers. There were four abnormal occurrences at the other NRC licensees. One involved contaminated radiopharmaceuticals used in several diagnostic administrations. Two involved therapeutic medical misadministrations. The other involved a significant internal exposure to iodine-125 to a hospital employee. There was one abnormal occurrence reported by an Agreement State; the event involved contaminatd radiopharmaceuticals used in several diagnostic administrations. The report also contains information updating some previously reported abnormal occurrences.

25631 **(NUREG—0675-Suppl.28) Safety Evaluation Report related to the operation of Diablo Canyon Nuclear Power Plant, Units 1 and 2 (Docket Nos. 50-275 and 50-323). Supplement No. 28.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Apr 1985. 635p. NTIS, PC A99/MF A01 - GPO $11.00. File Number TI85901407.

Supplement 28 to the Safety Evaluation Report for the Pacific Gas and Electric Company's application for licenses to operate Diablo Canyon Nuclear Power Plant, Units 1 and 2 (Docket Nos. 50-275 and 50-323) has been prepared jointly by the Office of Nuclear Reactor Regulation and the Region V Office of the US Nuclear Regulatory Commission. The supplement reports on the status of the staff's investigation, inspection, and evaluation of those allegations or concerns that have been identified to the NRC as of March 1, 1985.

25632 **(NUREG—1125-Vol.1) Compilation of reports of the Advisory Committee on Reactor Safeguards, 1957-1984. Volume 1. Project Reviews A-F.** (Nuclear Regulatory Commission, Washington, DC (USA). Advisory Committee on Reactor Safeguards). Apr 1985. 658p. NTIS, PC A99/MF A01 - GPO $11.00. File Number TI85901431.

This six-volume compilation contains over 1000 reports prepared by the Advisory Committee on Reactor Safeguards from September 1957 through December 1984. The reports are divided into two groups: Part 1: ACRS Reports on Project Reviews, and Part 2: ACRS Reports on Generic Subjects. Part 1 contains ACRS reports alphabetized by project name and within project name by chronological order. Part 2 categorizes the reports by the most appropriate generic subject area and within subject area by chronological order. This volume contains project reviews arranged alphabetically from A to F.

25633 **(NUREG—1125-Vol.3) Compilation of reports of the Advisory Committee on Reactor Safeguards, 1957-1984. Volume 3. Project Reviews Q-Z.** (Nuclear Regulatory Commission, Washington, DC (USA). Advisory Committee on Reactor Safeguards). Apr 1985. 561p. NTIS, PC A24/MF A01 - GPO $10.00. File Number TI85901433.

This six-volume compilation contains over 1000 reports prepared by the Advisory Committee on Reactor Safeguards from September 1957 through December 1984. The reports are divided into two groups: Part 1: ACRS Resports on Project Reviews, and Part 2: ACRS Reports on Generic Subjects. Part 1 contains ACRS reports alphabetized by project name and within project name by chronological order. Part 2 categorizes the reports by the most appropriate generic subject area and within subject area by chronological order. This volume includes reports arranged alpbabetically from Q to Z.

25634 **(NUREG—1125-Vol.4) Compilation of reports of the Advisory Committee on Reactor Safeguards, 1957-1984. Volume 4. Generic Subjects A-G.** (Nuclear Regulatory Commission, Washington, DC (USA). Advisory Committee on Reactor Safeguards). Apr 1985. 622p. NTIS, PC A99/MF A01 - GPO $11.00. File Number TI85901434.

This six-volume compilation contains over 1000 reports prepared by the Advisory Committee on Reactor Safeguards from September 1957 through December 1984. The reports are divided into two groups: Part 1: ACRS Reports on Project Reviews, and Part 2: ACRS Reports on Generic Subjects. Part 1 contains ACRS reports alphabetized by subject name and within project name by chronological order. Part 2 categorizes the reports by the most appropriate generic subject area and within subject area by chronological order. This volume contains generic reports arranged alphabetically from A to G.

25635 **(NUREG—1125-Vol.5) Compilation of reports of the Advisory Committee on Reactor Safeguards, 1957-1984. Volume 5. Generic Subjects H-R.** (Nuclear Regulatory Commission, Washington, DC (USA). Advisory Committee on Reactor Safeguards). Apr 1985. 628p. NTIS, PC A99/MF A01 - GPO $11.00. File Number TI85901435.

This six-volume compilation contains over 1000 reports prepared by the Advisory Committee on Reactor Safeguards from September 1957 through December 1984. The reports are divided into two groups: Part 1: ACRS Reports on Project Reviews, and Part 2: ACRS Reports on Generic Subjects. Part 1 contains ACRS reports alphabetized by project name and within project name by chronological order. Part 2 categorizes the reports by the most appropriate generic subject area and within subject area by chronological order. This volume presents generic subjects arranged alphabetically from H to R.

25636 **(NUREG—1125-Vol.6-App.) Compilation of reports of the Advisory Committee on Reactor Safeguards, 1957-1984. Volume 6. Generic Subjects R-Z, Appendices.** (Nuclear Regulatory Commission, Washington, DC (USA). Advisory Committee on Reactor Safeguards). Apr 1985. 571p. NTIS, PC A24/MF A01 - GPO $11.00. File Number TI85901354.

This six-volume compilation contains over 1000 reports prepared by the Advisory Committee on Reactor Safeguards from September 1957 through December 1984. The reports are divided into two groups: Part 1: ACRS Reports on Project Reviews, and Part 2: ACRS Reports on Generic Subjects. Part 1 contains ACRS reports alphabetized by project name and within project name by chronological order. Part 2 categorizes the reports by the most appropriate generic subject area and within subject area by chronological order. This volume contains the generic subjects with an alphabetical listing from R to Z.

25637 **(NUREG—1131) Financial analysis of potential retrospective premium assessments under the Price-Anderson system.** Wood, R.S. (Nuclear Regulatory Commission, Washington, DC (USA). Office of State Programs). Apr 1985. 19p. NTIS, PC A02/MF A01 - GPO $3.00. File Number TI85901388.

Ten representative nuclear utilities have been analyzed over the period 1981 to 1983 to evaluate the effects of three levels of retrospective premiums on various financial indicators. This analysis continues and expands on earlier analyses prepared as background for deliberations by the US Congress for possible extension or modification of the Price-Anderson Act.

25638 **(NUREG/CR—1755-Add.1) Technology, safety and costs of decommissioning nuclear reactors at multiple-reactor stations. Addendum 1. Effects on decommissioning of interim inability to dispose of wastes offsite.** Moore, E.B. Jr. (Pacific Northwest Labs., Richland, WA (USA)). Apr 1985. Contract AC06-76RL01830. 38p. NTIS (US Sales Only), PC A03/MF A01 - GPO $3.75. File Number TI85007690.

The purpose of this addendum is to examine the impacts of an interim inability to carry out offsite disposal of radioactive wastes and spent fuel on the decommissioning of a multiple-reactor power station. The example selected for study is a four-PWR station in which each PWR is prepared for safe storage at two-year intervals, held in safe storage for 100 years, and then finally decommissioned by deferred dismantlement at two year intervals. BWRs are neglected for simplicity and in the expectation that the results would be similar to those for PWRs. Only SAFSTOR is considered because DECON and ENTOMB are unsuitable by definition for interim storage of radioactive wastes and/or spent fuel. It is assumed that all radioactive wastes and spent fuel are shipped offsite by the end of decommissioning.

25639 **(NUREG/CR—2000-Vol.4-No.3) Licensee Event Report (LER) compilation for month of March 1985. Volume 4, No. 3.** (Oak Ridge National Lab., TN (USA)). Apr 1985. Contract AC05-84OR21400. 74p. (ORNL/NSIC—200-Vol.4-No.3). NTIS, PC A04/MF A01 - GPO. File Number TI85010555.

This monthly report contains Licensee Event Report (LER) operational information that was processed into the LER data file of the Nuclear Safety Information Center (NSIC) during this period. The LERs, from which this information is derived, are submitted to the Nuclear Regulatory Commission (NRC) by nuclear power plant licensees in accordance with federal regulations. The LER summaries in this report are arranged alphabetically by facility name and then chronologically by event date for each facility. Component, system, keyword, and component vendor indexes follow the summaries.

25640 **(NUREG/CR—3757) TRAN B-2: the effect of low steel content on fuel penetration in a non-melting cylindrical flow channel.** McArthur, D.A.; Mast, P.K. (Sandia National Labs., Albuquerque, NM (USA); Science Applications International Corp., Albuquerque, NM (USA)). Feb 1985. Contract AC04-76DP00789. 78p. (SAND—84-0814). NTIS, PC A05/MF A01. File Number TI85010436.

The TRAN B-Series of experiments is being conducted at Sandia National Laboratories to investigate the characteristics of fuel removal and freezing through the upper axial blankets of an LMFBR during the transition phase of a hypothetical core disruptive accident. The second experiment in this series, TRAN B-2, was performed in July 1983. This experiment involved the injection of a mixture of 95% UO_2 and 5% stainless steel into a simple thick-walled steel cylindrical flow channel. The initial temperature of the steel channel was low such that melting of the walls upon contact with the hot melt was not expected. Previous experiments under similar conditions but using pure UO_2 melts had shown stable crust growth and fairly long penetration distances. This experiment was intended to investigate whether those results were also applicable for the case of UO_2/steel mixtures. The results of the TRAN B-2 experiment, consisting of data from online instrumentation and post-irradiation examination, suggest that low steel content fuel/steel mixtures behave very similarly to pure UO_2 melts. The UO_2 in the mixture appears to be preferentially frozen out in the crust, such that the bulk melt material becomes richer in the stainless steel component. No evidence of bulk freezing or blockage formation was seen in the experiment.

25641 **(NUREG/CR—3855) Characterization of nuclear reactor containment penetrations. Final report.** Shackelford, M.H.; Bump, T.R.; Seidensticker, R.W. (Argonne National Lab., IL (USA)). Feb 1985. Contract AC04-76DP00789;W-31-109-ENG-38. 362p. (SAND—84-7139; ANL—84-87). NTIS, PC A16/MF A01. File Number TI85010463.

This report concludes a preliminary report prepared by ANL for Sandia, published as NUREG/CR-3855, in June 1984. The preliminary report, NUREG/CR-3855, presented the results of a survey of nuclear reactor containment penetrations, covering the number of plants surveyed at that time (22 total). Since that time, an additional 26 plants have been included in the survey. This final report serves two purposes: (1) to add the summary data sheets and penetration details for the additional plants now included in the survey; and (2) to confirm, revise, or add to analyses and discussions presented in the first report which, of course, were based solely on the earlier sample of 22 plants. This final report follows the outline and format of the preliminary survey report. In general, changes and additions to the preliminary report are implied, rather than stated as such to avoid repeated reference to that report. If no changes have been made in a section the title of the section of the previous report is simply repeated followed by "No Changes". Some repetition is used for continuity and clarity.

25642 **(NUREG/CR—3885-Vol.3) High-Temperature Gas-Cooled Reactor safety studies for the Division of Accident Evaluation. Quarterly progress report, July 1-September 30, 1984. Volume 3.** Ball, S.J.; Cleveland, J.C.; Harrington, R.M.; Weber, C.F.; Wilson, J.H. (Oak Ridge National Lab., TN (USA)). Apr 1985. Contract AC05-84OR21400. 26p. (ORNL/TM—9267/V3). NTIS, PC A03/MF A01 - GPO. File Number TI85010137.

Modeling and code development work on the modular High-Temperature Gas-Cooled Reactor (HTGR) were continued. The longer-term heatup accident scenario in which cavity wall cooling is lost was also modeled. Sensitivity studies were run for a variety of parameter variations. Fission-product (FP) release and transport experiments were completed for several additional elements. 11 refs., 6 figs.

25643 **(NUREG/CR—3905-Vol.1-Rev.1) Sequence Coding and Search System for licensee event reports: user's guide. Volume 1, Revision 1.** Greene, N.M.; Mays, G.T.; Johnson, M.P. (Oak Ridge National Lab., TN (USA); JBF Associates, Knoxville, TN (USA); Science Applications International Corp., Oak Ridge, TN (USA)). Apr 1985. Contract AC05-84OR21400. 162p. (ORNL/NSIC—223-Vol.1-Rev.1). NTIS, PC A08/MF A01 - GPO $5.50. File Number TI85010858.

Operating experience data from nuclear power plants are essential for safety and reliability analyses, especially analyses of trends and patterns. The licensee event reports (LERs) that are submitted to the Nuclear Regulatory Commission (NRC) by the nuclear power plant utilities contain much of this data. The NRC's Office for Analysis and Evaluation of Operational Data (AEOD) has developed, under contract with NSIC, a system for codifying the events reported in the LERs. The primary objective of the Sequence Coding and Search System (SCSS) is to reduce the descriptive text of the LERs to coded sequences that are both computer-readable and computer-searchable. This system provides a structured format for detailed coding of component, system, and unit effects as well as personnel errors. The database contains all current LERs submitted by nuclear power plant utilities for events occurring since 1981 and is updated on a continual basis. This four volume report documents and describes SCSS in detail. Volume 1 is a User's Guide for searching the SCSS database. This volume contains updated material through February 1985 of the working version of ORNL/NSIC-223, Vol. 1.

25644 **(NUREG/CR—3905-Vol.2) Sequence Coding and Search System for licensee event reports: code listings. Volume 2.** Gallaher, R.B.; Guymon, R.H.; Mays, G.T.; Poore, W.P.; Cagle, R.J.; Harrington, K.H.; Johnson, M.P. (Oak Ridge National Lab., TN (USA); JBF Associates, Knoxville, TN (USA)). Apr 1985. Contract AC05-84OR21400. 270p. (ORNL/NSIC—223-Vol.2). NTIS, PC A12/MF A01 - GPO $7.00. File Number TI85010859.

Operating experience data from nuclear power plants are essential for safety and reliability analyses, especially analyses of trends and patterns. The licensee event reports (LERs) that are submitted to the Nuclear Regulatory Commission (NRC) by the nuclear power plant utilities contain much of this data. The NRC's Office for Analysis and Evaluation of Operational Data (AEOD) has developed, under contract with NSIC, a system for codifying the events reported in the LERs. The primary objective of the Sequence Coding and Search System (SCSS) is to reduce the descriptive text of the LERs to coded sequences that are both computer-readable and computer-searchable. This system provides a structured format for detailed coding of component, system, and unit effects as well as personnel errors. The database contains all current LERs submitted by nuclear power plant utilities for events occurring since 1981 and is updated on a continual basis. Volume 2 contains all valid and acceptable codes used for searching and encoding the LER data. This volume contains updated material through amendment 1 to revision 1 of the working version of ORNL/NSIC-223, Vol. 2.

25645 **(NUREG/CR—3905-Vol.3) Sequence Coding and Search System for licensee event reports: coder's manual. Volume 3.** Gallaher, R.B.; Guymon, R.H.; Mays, G.T.; Poore, W.P.; Cagle, R.J.; Harrington, K.H.; Johnson, M.P. (Oak Ridge National Lab., TN (USA); JBF Associates, Knoxville, TN (USA)). Apr 1985. Contract AC05-84OR21400. 381p. (ORNL/NSIC—223-Vol.3). NTIS, PC A17/MF A01 - GPO $8.50. File Number TI85010860.

Operating experience data from nuclear power plants are essential for safety and reliability analyses, especially analyses of trends and patterns. The licensee event reports (LERs) that are submitted to the Nuclear Regulatory Commission (NRC) by the nuclear power plant utilities contain much of this data. The NRC's Office for Analysis and Evaluation of Operational Data (AEOD) has developed, under contract with NSIC, a system for codifying the events reported in the LERs. The primary objective of the Sequence Coding and Search System (SCSS) is to reduce the descriptive text of the LERs to coded sequences that are both computer-readable and computer-searchable. This four volume report documents and describes SCSS in detail. Volumes 3 and 4 provide a technical processor, new to SCSS, the information and methodology necessary to capture descriptive data from the LER and to codify that data into a structured format and serve as reference material for the more experienced technical processor, and contains information is essential for the more advanced user who needs to be familiar with the intricate coding techniques in order to retrieve specific details in a sequence. This volume contains updated material through amendment 1 to revision 1 of the working version of ORNL/NSIC-223, Vol. 3.

25646 **(NUREG/CR—3905-Vol.4) Sequence Coding and Search System for licensee event reports: coder's manual. Volume 4.** Gallaher, R.B.; Guymon, R.H.; Mays, G.T.; Poore, W.P.; Cagle, R.J.; Harrington, K.H.; Johnson, M.P. (Oak Ridge National Lab., TN (USA); JBF Associates, Knoxville, TN (USA)). Apr 1985. Contract AC05-84OR21400. 344p. (ORNL/NSIC—223-Vol.4). NTIS, PC A15/MF A01 - GPO $8.00. File Number TI85010861.

Operating experience data from nuclear power plants are essential for safety and reliability analyses, especially analyses of trends and patterns. The licensee event reports (LERs) that are submitted to the Nuclear Regulatory Commission (NRC) by the nuclear power plant utilities contain much of this data. The NRC's Office for Analysis and Evaluation of Operational Data (AEOD) has developed, under contract with NSIC, a system for codifying the events reported in the LERs. The primary objective of the Sequence Coding and Search System (SCSS) is to reduce the descriptive text of the LERs to coded sequences that are both computer-readable and computer-searchable. This four volume report documents and describes SCSS in detail. Volume 3 and 4 provide a technical processor, new to SCSS, the information and methodology necessary to capture descriptive data from the LER and to codify that data into a structured format and serve as reference material for the more experienced technical processor, and contains information that is essential for the more advanced user who needs to be familiar with the intricate coding techniques in order to retrieve specific details in a sequence. This volume contains updated material through amendment 1 to revision 1 of the working version of ORNL/NSIC-223, Vol. 4.

25647 **(NUREG/CR—3980-Vol.2) Light-water-reactor safety fuel systems research programs. Quarterly progress report, April-June 1984. Volume 2.** (Argonne National Lab., IL (USA)). Feb 1985. Contract W-31-109-ENG-38. 33p. (ANL—84-61-Vol.2). NTIS, PC A03/MF A01 - GPO. File Number TI85008727.

This progress report report summarizes work performed by the Materials Science and Technology Division of Argonne National Laboratory during April, May, and June 1984 on water reactor safety problems related to fuel and cladding. The research and development areas covered are Transient Fuel Response and Fission Product Release and Clad Properties for Code Verification.

25648 **(NUREG/CR—4124) NDE of stainless steel and on-line leak monitoring of LWRs. Annual report, October 1983-September 1984.** Kupperman, D.S.; Claytor, T.N.; Prine, D.W. (Argonne National Lab., IL (USA)). Apr 1985. Contract W-31-109-ENG-38. 41p. (ANL—85-5). NTIS, PC A03/MF A01 - GPO. File Number TI85009973.

The application of ultrasonic velocity and attenuation measurements to characterize the microstructure of structural materials is discussed. Results of a workshop on NDE of stainless steel pipes with weld overlays are presented. No currently available, single leak-detection method for reactor cooling systems combines optimal leakage detection sensitivity, leak-locating ability, and leakage measurement accuracy. Current practice with regard to leak detection has been reviewed and assessed for 74 operating plants, including both BWRs and PWRs. Seven cracks, including three field-induced IGSCC specimens and two thermal-fatigue cracks, have been installed in the acoustic leak detection (ALD) facility at ANL. Cross-correlation techniques to improve leak location capabilities have been successfully demonstrated on the laboratory pipe run by use of 375-kHz transducers on waveguides and an electronically simulated leak signal. Preliminary leak detection and location tests

have also been run at ANL with a breadboard ALD system. In addition to ALD experiments, laboratory tests have been carried out to help assess the effectiveness of moisture-sensitive tape.

25649 (NUREG/CR—4155) TRAC-PF1/MOD1 independent assessment: Northwestern University perforated-plate CCFL tests. Dobranich, D. (Sandia National Labs., Albuquerque, NM (USA)). Feb 1985. Contract AC04-76DP00789. 44p. (SAND—85-0172). NTIS, PC A03/MF A01 - GPO. File Number TI85010598.

The TRAC-PF1/MOD1 independent assessment project at Sandia is part of an overall effort funded by the NRC to determine the ability of various systems codes to predict the detailed thermal/hydraulic response of LWRs during accident and off-normal conditions. As part of this effort, calculations for some of the Northwestern University perforated-plate CCFL tests have been performed. Two input models were constructed to represent the rectangular test channel: a two-dimensional model and a faster-running one-dimensional model. The results of both models indicate that for high water flow rates, with the water injected vertically above a perforated plate, TRAC overpredicts the steam flow rate necessary for complete weeping (CCFL). However, for flow conditions more typical of PWR transients, TRAC provides a reasonable prediction of weeping.

25650 (NUREG/CR—4173) CORSOR user's manual. Kuhlman, M.R.; Lehmicke, D.J.; Meyer, R.O. (Battelle Columbus Labs., OH (USA)). Mar 1985. 56p. (BMI—2122). NTIS, PC A04/MF A01 - GPO $4.50. File Number TI85901325.

The CORSOR code simulates the release of fission products and structural materials from a reactor core during the in-vessel period of a severe accident in a light water reactor. The code is a simple, empirically based treatment of release and does not treat detailed mechanisms for release from high temperature fuel. The first-order release rate coefficients for the species considered are presented, the input requirements of the code are described, and an example input and output stream is supplied in an appendix.

25651 (PNL-SA—10181) State of emergency preparedness at US power reactors-preliminary findings. Munson, L.H.; Desrosiers, A.E.; Grimes, B.K. (Pacific Northwest Labs., Richland, WA (USA)). Jun 1982. Contract AC06-76RL01830. 14p. (CONF-820655—14). NTIS, PC A02/MF A01. File Number TI85007428.

From Health Physics Society annual meeting; Las Vegas, NV, USA (27 Jun 1982).

As part of a major effort that began in 1979, the US Nuclear Regulatory Commission (NRC) has implemented a three-phase effort to evaluate emergency preparedness at licensed reactors. The program includes: review and evaluation for adequacy of emergency plans submitted by reactor licensees; appraisal of procedures, equipment, facilities and personnel capability; and observation of drills and exercises designed to test the licensee's and state and local authorities' capabilities to implement the emergency plans. This effort, the Emergency Preparedness Implementation Appraisal (EPIA) Program, is being conducted by the NRC with the technical assistance of the Pacific Northwest Laboratory. The EPIA program uses a team of technically qualified professionals from disciplines covering all aspects of emergency preparedness, to perform an in-depth evaluation of the emergency preparedness program at each facility. This evaluation uses a modified Management Oversight and Risk Tree (MORT) analytic logic methodology. The tree contains six major elements of emergency preparedness for review: administration, organization, training and re-training, facilities and equipment, implementing procedures, and coordination with offsite agencies. The seventh element of MORT, drills and exercises, is reviewed by direct observation during those activities. Fifty-four (54) of 65 site evaluations have been completed and some preliminary conclusions are drawn from those evaluations.

25652 (SAND—85-0885C) Uncertainty and sensitivity analysis for reactor accident consequence models. Alpert, D.J.; Helton, J.C. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 19p. (CONF-850471—2). NTIS, PC A02/MF A01. File Number TI85010387.

From Workshop on methods for assessing the off-site radiological consequences of nuclear accidents; Luxembourg, Luxembourg (15 Apr 1985).

Uncertainties in health and economic consequence models stem principally from two types of uncertainties: limitations in the models and limitations in the data used in these models. This paper presents an overview of uncertainty and sensitivity analysis for reactor accident consequence models. Section II presents examples of previous treatments of uncertainty; Section III describes some of the possible approaches to treatment uncertainty; Section IV illustrates the use of one of these techniques; and finally, Section V presents a summary and discussion.

25653 (UCID—20397) Assessment of value-impact associated with the elimination of postulated pipe ruptures from the design basis for nuclear power plants. Holman, G.S.; Chou, C.K. (Lawrence Livermore National Lab., CA (USA)). 29 Mar 1985. Contract W-7405-ENG-48. 112p. NTIS, PC A06/MF A01 - GPO; GPO Dep. File Number TI85010404.

The US Nuclear Regulatory Commission is proposing to amend the regulations that currently require that the design basis for nuclear power plants include the postulation of dynamic effects from loss of coolant accidents up to and including the double-ended rupture of the largest pipe in the reactor coolant system. Proposed modifications would allow analyses to serve as a sufficient basis for excluding dynamic effects, including but not necessarily limited to pipe whip and jet impingement, associated with specific pipe ruptures. Only dynamic effects would be impacted; current design requirements for containment sizing and discharge capacity of emergency core cooling systems would remain unchanged. This report presents a detailed analysis of value-impact associated with the proposed amendment for PWR reactor coolant loop piping and for BWR recirculation loop piping. The effect of extending application of the proposed rule change to other piping systems is also assessed in a less quantitative manner.

25654 Gas tagging and cover gas combination for nuclear reactor. Gross, K. C.; Laug, M. T. (to The United States of America as represented by the United States Department of Energy). US Patent 4,495,143. 22 Jan 1985. Filed date 26 Sep 1983. vp.

PAT-APPL-535462.

The invention discloses the use of stable isotopes of neon and argon, that are grouped in preselected different ratios one to the other and are then sealed as tags in different cladded nuclear fuel elements to be used in a liquid metal fast breeder reactor. Failure of the cladding of any fuel element allows fission gases generated in the reaction and these tag isotopes to escape and to combine with the cover gas held in the reactor over the fuel elements. The isotopes specifically are Ne^{20}, Ne^{21} and Ne^{22} of neon and Ar^{36}, Ar^{38} and Ar^{40} of argon, and the cover gas is helium. Serially connected cryogenically operated charcoal beds are used to clean the cover gas and to separate out the tags. The first or cover gas cleanup bed is held between approximately 0° and-25° C. operable to remove the fission gases from the cover gas and tags and the second or tag recovery system bed is held between approximately -170° and -185° C. operable to isolate the tags from the cover gas. Spectrometric analysis further is used to identify the specific tags that are recovered, and thus the specific leaking fuel element. By cataloging the fuel element tags to the location of the fuel elements in the reactor, the location of the leaking fuel element can then be specifically determined.

25655 (DOE/ID/12488—T1-Vol.1-Rev.0) Graphic Display Development Program. Volume I, Revision 0 . (Operations Engineering, Inc., Fremont, CA (USA)). Dec 1984. Contract AC07-83ID12488. 116p. (OEI—8304-1-Vol.1-Rev.0). NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85011076.

The objective of this project is to demonstrate the feasibility and utility of developing a set of graphic displays to support symptom-based emergency operating procedures (EOPs). Development of generic graphic displays is based on Revision 3 of the symptomatic Emergency Procedure Guidelines (EPGs) prepared by the BWR Owners' Group (BWROG), and development of plant-specif-

ic graphic displays is based on a set of emergency operating procedures developed from these EPGs.

25656 **(DOE/ID/12488—T1-Vol.2-Rev.0-Apps.) Graphic Display Development Program. Volume II, Revision 0. Appendices.** (Operations Engineering, Inc., Fremont, CA (USA)). Dec 1984. Contract AC07-83ID12488. 792p. (OEI—8304-1-Vol.2-Rev.0-Apps.). NTIS, PC A99/MF A01; 1; GPO Dep. File Number DE85011078.

The objective of this project is to demonstrate the feasibility and utility of developing a set of graphic displays to support symptom-based emergency operating procedures (EOPs). Development of generic graphic displays is based on Revision 3 of the symptomatic Emergency Procedure Guidelines (EPGs) prepared by the BWR Owners' Group (BWROG), and development of plant-specific graphic displays is based on a set of emergency operating procedures developed from these EPGs.

25657 **(CE-Trans—8061) Behavior of pumps conveying two-phase liquid flow.** Grison, P.; Lauro, J.F. Translated from *Houille Blanche ;* No. 6/7, 405-411(1979). 20p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85901160. DE85901160

Analysis of a Loss of Coolant Accident (LOCA) in light water reactors has shown that the flow of water through the fractured loop and the flow distribution between other intact loops are two important parameters. Forecasts will therefore depend largely on the behavior of the primary pumps which represent either one of the basic obstacles to the passage of water (fractured loop), of the component enabling the remaining flow to circulate (intact loops). It is difficult enough to predict the behavior of a pump operating in single-phase flow under conditions far-removed from the range of normal operation, and even more difficult to do so in cases of two-phase steam-water flow. In addition, analysis of the phenomena which occur, has shown that it is impossible to obtain complete similarity, that is to say that the results obtained on a small-scale model cannot be directly extrapolated to an industrial scale plant. The aim of this study is therefore to formulate a relatively simple theoretical model to provide an initial assessment of the pump behaviour. A more detailed analysis of the physical phenomena should then enable the forecasts for particular flow conditions to be improved.

25 ENERGY STORAGE

REFER ALSO TO CITATION(S) 25474

2501 Magnetic

REFER ALSO TO CITATION(S) 25950

2506 Thermal

REFER ALSO TO CITATION(S) 25486, 25681

25658 **(CTH-JVG—11) Freezing of clay in a soil heat store at Utby.** Modin, B.; Rhen, I. (Chalmers Inst. of Tech., Goeteborg (Sweden). Earth Heat Pump Group). Aug 1982. 58p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. File Number DE85750872.

This report treats the effects on clay from freezing of the soil around the vertical collectors coils of an earth source heat pump. The experiments show that the shear strength of frozen and thawed clay is considerably reduced. This means that if freezing is allowed around the coils, geotechnical problems may arise, depending on the accumulator position, size, degree of freezing, inclination of ground a.s.o. The freezing also changes the thermal properties of the clay, at the site examined, the thermal conduction increased from 1.0 to 1.5 W/m C degrees at a temperature change from 0 C degree to -5 C degrees. At thawing, some water is drained, and a reduction of the water content is produced in the zone that was frozen. This may cause settling in the ground above the coils.

25659 (MRI/SOL—1101, pp 223-232) **Customer side of the meter: battery and thermal storage.** McCormack, R.A. (Thermal Energy Storage, Inc., San Diego, CA). 1982. NTIS, PC A19/MF A01. File Number DE84015232. (CONF-820312—; SERI/CP—270-1521).

From Solar storage workshop; Jeddah, Saudi Arabia (21 Mar 1982).

Thermal energy storage for solar, waste heat and off-peak electric systems has reached the point of commercial acceptability in the US. Systems are available for water and space heating, air conditioning and refrigeration. European experience in electric load transfer augurs well for the complete development off-peak electric markets in the US. Electric utility company avoided capital costs are the most significant factor in setting customer incentive tariffs.

2509 Batteries

REFER ALSO TO CITATION(S) 25445, 25447, 25659, 25896

25660 **(AD-A—142976) Lithium cell reactions. Interim report, December 1981-May 1983.** Clark, W.; Dampier, F.; Lombardi, A.; Cole, T. (GTE Labs., Inc., Waltham, MA (USA)). Dec 1983. 89p. (AFWAL-TR—83-2083). NTIS, PC A05/MF A01. File Number TI85900857.

This report presents the results of a program that investigated reactions occurring in lithium-thionyl chloride cells for a range of specified test conditions and also performed detailed analyses for impurities present in cell components, assessed the impact of each impurity on cell performance and safety, and recommended concentration limits for detrimental impurities. Methods used in the program included linear sweep voltammetry, constant current coulometry, infrared spectroscopy, chemical analysis of the reagents and cell components, and cell discharge tests.

25661 **(AD-A—149626/4/XAB) Nickel-cadmium battery cell reversal from resistive-network effects. Technical report.** Zimmerman, A.H. (Aerospace Corp., El Segundo, CA (USA). Chemistry and Physics Lab.). 17 Dec 1984. 26p. (TR—0084A(5945-01)-2). NTIS, PC A03/MF A01.

During the individual cell short-down procedures often used for storing or reconditioning nickel-cadmium (Ni-Cd) batteries, it is possible for significant reversal of the lowest capacity cells to occur. The reversal is caused by the finite resistance of the common current-carrying leads in the resistive network that is generally used during short-down. A model is developed to evaluate the extent of such a reversal in any specific battery, and the model is verified by means of data from the short-down of a 4-cell, 3.5-A h battery. Computer simulations of short-down on a variety of battery configurations indicate the desirability of controlling capacity imbalances arising from cell configuration and battery management, limiting variability in the short-down resistors, minimizing lead resistances, and optimizing lead configurations.

25662 **(AD-A—150116/2/XAB) Solid electrolytes: mechanisms for achieving optimal conductivity. Final report, 15 October 1981-14 October 1984.** Ratner, M.A. (Northwestern Univ., Evanston, IL (USA). Dept. of Chemistry). 30 Nov 1984. 26p. NTIS, PC A03/MF A01.

In an attempt to understand mobility mechanisms, to predict optimal conduction conditions for solid electrolytes, and to develop methods for calculating conductivity in a classical many-body systems, calculations have been completed for a variety of one-, two-, and three-dimensional model lattice systems. These calculation involve Monte-Carlo simulation, self-consistent-field techniques, and reduced Langevin dynamics, and have been devoted to the actual calculation of the frequency-dependent conductivity tensor sigma omega, and of its variation with important experimental variables (concentration, pressure, temperature, trap sites, identify of mobile ion, lattice geometry). The objective of this research has been to provide hard numerical data for three purposes: understanding and prediction of the effects of variation of external parameters (temperature, doping, compensation, ion exchange) on conductivity, comparison of good numerical data with extant formal theory to focus on the most important variables or achieving optimal conduc-

tivity, and development of a mechanistic model (including such extremes as hopping and liquid-like diffusion) to correlate the behaviors of a large number of framework conductors.

25663 **(CONF-841073—1) Lithium-alloy/iron sulfide battery design studies.** Chilenskas, A.A. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 11p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85007991.

From Electric vehicle contractors' coordination meeting; Las Vegas, NV, USA (23 Oct 1984).

The DOE/EHV sponsored design studies carried out at Argonne and the integration of these studies with the EPRI program for the development of an advanced van battery are discussed.

25664 **(DOE/CE—0121) Electrochemical Energy Storage Branch annual progress report, October 1, 1983-September 30, 1984.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC. Energy Storage Div.). Jan 1985. 34p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85007592.

The activities of the Electrochemical Energy Storage Branch are highlighted, including the Technology Base Research and the Exploratory Technology Development and Testing projects within the Electrochemical Energy Storage Program for the 1984 fiscal year. General Headquarters activities are presented first; and then, a summary of the Director Controlled Milestones, followed by other major accomplishments. A listing of the workshops and seminars held during the year is also included.

25665 **(ERP/MSL—83-94(TR)) Progress in solid electrolytes.** Wheat, T.A.; Ahmad, A.; Kuriakose, A.K. (eds.). (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario). May 1983. 581p. NTIS (US Sales Only), PC A25/MF A01. File Number DE84901497.

This volume brings together comprehensive state-of-the-art papers on the recent developments in understanding and using solid electrolytes. Internationally recognized experts were invited by CANMET to contribute papers on selected topics in this rapidly expanding field. In seeking contributions to this volume, an attempt was made to strike a balance between research- and development-oriented topics and hence the papers are loosely grouped under the general headings of behavior (first cationic then anionic conductors) and applications. Collectively, they provide a current picture of the R and D in this field; in part, they reflect the significant developments that have occurred in recent years leading to commercial exploitation and, in part, they also indicate the challenges of the future.

25666 **Carbon corrosion in alkaline oxygen electrodes.** Gestaut, L.; Bennett, W.R.; Clere, T.; Huang, J.; Knerr, L.; Wheeler, D. (ELTECH Systems Corporation, Fairport Harbor, OH). *Proceedings - Electrochemical Society;* **84-5**: 344-362(Aug 1983). (CONF-8308116—).

From Workshop on the electrochemistry of carbon; Cleveland, OH, USA (17 Aug 1983).

Active carbon electrodes have been fabricated for use in alkaline electrolytes in both constant discharge and cyclic discharge modes. In both cases carbon corrosion is a life limiting phenomenon. Loss of platinum surface area and carbon surface area are electrochemically observed in constantly discharged electrodes. In electrodes undergoing cyclic discharge a decrease in the carbon electrode surface and bulk platinum are observed. The rate of loss of surface area of an uncatalyzed structure is significantly less. Thus degradation of the electrode structure appears to be catalyzed by the presence of platinum.

25667 **Carbon electrochemistry in alkaline systems.** Berk, L.; Zuckerbrod, D. (Westinghouse Research and Development Center, Pittsburgh, Pennsylvania). *Proceedings - Electrochemical Society;* **84-5**: 238-250(Aug 1983). (CONF-8308116—).

From Workshop on the electrochemistry of carbon; Cleveland, OH, USA (17 Aug 1983).

The electrochemical activity of a high surface area furnace black, Black Pearls 2000 and an acetylene black, Shawinigan Black, were studied in 25% KOH at temperatures from 45°C to -15°C. A relationship was found between the graphitic character of the carbons and their activities for oxygen formation and surface oxide formation, the furnace black being more active for surface oxide formation and the acetylene black being more active for oxygen generation. The carbons behaved similarly in the cathodic region, exhibiting two distinct peaks apparently related to the reduction of oxygen or of surface oxides.

25668 **The electrochemical properties of graphite and carbon.** Yeager, E.; Gupta, S.; Molla, J.A. (Case Center for Electrochemical Sciences, and The Chemistry Department, Case Western Reserve University, Cleveland, Ohio 44106). *Proceedings - Electrochemical Society;* **84-5**: 123-157(Aug 1983). (CONF-8308116—).

From Workshop on the electrochemistry of carbon; Cleveland, OH, USA (17 Aug 1983).

Carbon and graphite are often used as supports for electrocatalysts, but also have an electrocatalytic function in such electrode reactions as O_2 reduction in alkaline electrolytes, Cl_2 generation in brine and $SOCl_2$ reduction in lithium-thionyl chloride batteries. These catalytic functions involve specific chemical functional groups bound to the carbon and graphite surfaces. The factors controlling O_2 reduction with various types of carbon electrodes of both low and high surface area are reviewed. Of particular importance is the role of hydrogen peroxide. The role of the functionality of the carbon in the electrocatalysis will be discussed.

29 ENERGY PLANNING AND POLICY

25669 **(NP—5770214) Bolivia - energy situation 1983.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Oct 1984. 11p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE85770214.

The energy situation of Bolivia is reviewed on the basis of some relevant data. Its energy policy is commented on, and developments in electric power generation are described as well as the trends observed for the various energy sources. Figures are given on external trade and the balance of payments.

25670 **(NP—5770215) Paraguay - energy situation 1983.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Sep 1984. 17p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE85770215.

The energy situation of Paraguay is reviewed on the basis of some relevant data. Its energy policy is commented on, and developments in electric power generation are described as well as the trends observed for the various energy sources. Figures are given on external trade and the balance of payments.

25671 **(NP—5770216) Algeria - energy situation 1983.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Sep 1984. 23p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE85770216.

The energy situation of Algeria is reviewed on the basis of some relevant data. Its energy policy is commented on, and developments in electric power generation are described as well as the trends observed for the various energy sources. Figures are given on external trade and the balance of payments.

2901 Energy Analysis And Modeling

REFER ALSO TO CITATION(S) 25683, 25690, 25691

25672 **(NP—5770202) Development costs of Karlsruhe - the results of scenario computations with different energy prices.** Kowalski, J.S. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Inst. fuer Wirtschaftspolitik und Wirtschaftsforschung). 1984. 31p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85770202.

The basic topic of this work is the investigation of the dependence of the structural development of towns on rising energy prices. In this connection a number of data on the geographic development of Karlsruhe are presented as examples. Finally, a sim-

plified form of an optimization model for the calculation of comparable costs of different scenarios in regard of the future development of towns is developed.

25673 **(PB—85-146066/XAB) Evaluation of sources used to develop data measuring freight flows of selected energy products for the multiregional input-output model. Final report.** Kaufman, H.A.; Skolnik, J. (Faucett (Jack) Associates, Inc., Chevy Chase, MD (USA)). May 1982. 134p. NTIS, PC A07/MF A01.

The report presents and evaluates the preliminary results of the tabulation of freight flows for selected energy products considered for inclusion in the Miltiregional Input-Output Model (MRIO). These freight flows are an essential component of the MRIO, since they link the transactions between the producing and consuming sectors among the states. The balance between each states supply and disposition is discussed along with the general methodology for completion of the trade flows. Complete documentation of the data development methodology is given. The energy products include, coal, coke and breeze, crude petroleum, residual fuel oil, distillate fuel oil, gasoline, and jet fuel oil.

2902 Economics And Sociology

REFER ALSO TO CITATION(S) 25217, 25687, 25690, 25717, 26125

25674 **(AD-P—004376/0/XAB) Energy for field operations in developing countries.** Crossley, C.P. (Silsoe Coll. (UK)). Aug 1984. 13p. NTIS, PC A02/MF A01.

This article is from Proceedings of the International Conference on the Performance of Off-Road Vehicles and Machines (8th), Volume 3, held at Cambridge, England on August 5-11, 1984, AD-A150 653, p919-931.

Oil prices have risen from 2 dollars per barrel in 1972 to over 30 dollars per barrel in 1982/83. After adjusting for inflation the 1972 price would be equivalent to about 14 dollars in 1982, so it can be seen that prices have more than doubled in real terms in ten years. The effect of such a price increase has been particularly severe in those developing countries having no oil supply sources of their own. Agricultural production of cash crops for export is very often an important source of foreign exchange for the purchase of fuel, and in many cases world prices of exported commodities have not increased substantially over the same period. Since agricultural production is an important aspect of the economy of most developing countries and usually involves a large proportion of the population in subsistence or cash crop agriculture, there is likely to be a continuing need for engine powered mechanization in the agricultural sector, using both large- and small-scale equipment. Irraditional hand and animal power sources overcome the fuel-supply problem and should be the preferred alternatives where they are suitable, but due in part to the limited power available from these sources it is necessary to utilize field machinery in many situations. This paper identifies the stages of energy use associated with engine-powered field equipment, and investigates the possibilities for energy reduction within the various stages.

25675 **(EUR—9443-EN) European project for a multinational macrosectoral model.** Alcantara, G. d'; Italianer, A. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1984. 190p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

This paper describes the HERMES project, a multinational macrosectoral European econometric modelling effort, sponsored by the Directorates General II (Economic and Financial Affairs), XII (Science, Research and Development), XVII (Energy) and the SOEC. The set-up of the model is sketched against the background of problems of growth, unemployment, inflation, trade balances, government balances and energy policy. Although the definitions of the variables and a complete specification of the model are given in the Appendix, the major features of the model are described extensively in the text. These include private and collective consumption (incl. a consumer demand system), the putty-clay production process, price and wage formation, sectoral bilateral trade flows and integrated energy economy modelling.

25676 **(PB—85-152569/XAB) Marketing of lift clubs. Technical professional circular.** (Department of Transport, Pretoria (South Africa)). Aug 1980. 50p. (In Afrikaans). (U—10/9). NTIS, PC E04/MF E01.

This report deals with the promotion of lift clubs or car pools, setting a target of 30% fuel saving. United States Federal involvement is dealt with. Initially promotion concentrated on bringing potential club members together but lack of success led to the identification of incentives and ultimately to concentration on employer oriented approaches. At present only Johannesburg and Pretoria have taken an active interest in promoting lift clubs. These can lead to significant savings to Members. Possible incentives are identified within the framework of the Urban Transport Act 78 of 1977 and a lift club marketing campaign is proposed.

25677 **(PB—85-160778/XAB) Technological change and its labor impact in five energy industries. Final report 1960-1985.** Zeisel, R.N.; Riche, R.W. (Bureau of Labor Statistics, Washington, DC (USA)). Apr 1979. 75p. (BLS-Bull—2005). NTIS, PC A04/MF A01.

See also PB-279964. Library of Congress catalog card no. 79-11188.

This study appraises emerging technological changes and their impact on productivity and jobs in the coal mining, oil and gas extraction, petroleum refining, petroleum pipeline, and electric and gas utilities industries.

2903 Environment, Health, And Safety

REFER ALSO TO CITATION(S) 25174, 25405, 25406, 25574, 25698, 26087, 26118, 26119, 26122

2904 Natural Resources

REFER ALSO TO CITATION(S) 25254, 25686, 25720

25678 **(PB—85-164192/XAB) Minerals yearbook, 1983. Volume 1. Metals and minerals.** (Bureau of Mines, Washington, DC (USA)). 1984. 964p. (BM-MYB—1983-VOL-1). NTIS, PC A99/MF E06.

See also PB84-159359.

This volume of the Minerals Yearbook, covering metals and minerals, contains 73 commodity or commodity group chapters with data on approximately 90 minerals that were obtained as a result of the mineral information gathering activities of the Bureau of Mines. In addition, the volume contains a chapter on mining and quarrying trends and a statistical summary.

2905 Research, Development, Demonstration, And Commercialization

REFER ALSO TO CITATION(S) 25240, 25405, 25406, 25529, 25543, 25574, 26552

25679 **(DOE/ER/30031—T1) Benefit analysis of selected accomplishments of DOE's Office of Health and Environmental Research. Final report.** Lago, A.M.; Ramsdell, M.J.; Knapp, S.F.; Siddique, S.I. (Ecosometrics, Inc., Bethesda, MD (USA)). 29 Nov 1982. Contract AC01-82ER30031. 150p. (RR—166). NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE85010337.

The benefits arising from the following accomplishments of DOE's Office of Health and Environmental Research (OHER) were estimated: (1) standardization of modular instruments (CMAC, NIM); (2) energy dispersive x-ray fluorescence spectrometry; and (3) gamma-ray spectrometry. (ACR)

25680 **(Zfl-Mitt—86) Reports of the Central Institute for Isotopes and Radiation Research.** (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Apr 1984. 98p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE85780871.

Separate entries were made in the data base for the sections included.

2906 Nuclear Energy

REFER ALSO TO CITATION(S) 25298, 25321, 25529, 25543, 25574

2908 Waste Heat Utilization

25681 **(BMFT-FB-T—84-289) Preliminary project for preparing the construction and operation of a large steel vessel to be used as thermal accumulator in a district heating system.** Mathenia, T. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Dec 1984. 112p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE85751608.

The preliminary project includes the investigation of thermal accumulators-operation under pressureless and pressurized conditions, and partly also alternative storage concepts. The aim is to improve the use of waste heat from industrial plants, and a more economic operation of the district-heating transport system, operated by the District-Heating Grid Niederrhein (FVN), as well as the connected long-distance control and supply systems. In particular, HP-accumulators were developed and constructed for the acceptance of large output change gradients in combined heat and power systems. Hot water storage in large steel vessel up to 40 000 m^3, and a thermochemical energy storage in the district heating system were investigated.

25682 **(EPRI-EA—3995) COGEN3: a computer model for design, costing, and economic optimization of cogeneration projects. Final report.** Duff, M.C.; Price, W.G. Jr.; Davis, A.N.; Manuel, E.H. Jr. (Mathtech, Inc., Princeton, NJ (USA)). Apr 1985. 40p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920630.

COGEN3 is a computer software package that combines the capabilities for: conceptual engineering design, costing, economic optimization, and financial evaluation of cogeneration projects. COGEN3 requires the user to enter data on the thermal and electric loads to be supplied by the cogeneration system. The prices for fuel and electricity must also be entered. COGEN3 will then solve for the equipment selection, fuel selection, equipment operation, and electricity purchase or sales arrangement with the electric utility that allows the thermal and electric loads to be supplied at lowest total cost. It then performs a financial analysis of the optimal design. COGEN3 can be applied to the analysis of industrial, commercial and institutional cogeneration systems. Customer, utility, and third-party ownership options are available. Either internal or user-supplied equipment data can be used. Various electric rate structures can be considered, including: time-of-use rates, declining block rates, hours-of-use rates, and billing demand ratchets. Both the purchase or sale of electricity and steam can be analyzed. The program is now operational at several electric utilities as part of a testing and demonstration effort sponsored by EPRI. 2 figs., 4 tabs.

25683 **(NP—5770207) Development and site planning for district heat supply.** Tietz, H.P. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Inst. fuer Staedtebau und Landesplanung). 1984. 231p. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE85770207.

The work starts by pointing out some important connections between town planning and energy supply and the role of district heat supply in town planning, and goes on to describe and analyse methods known at present to establish the space heat requirement of a settlement and to develop a modified method (via aerial pictures). Furthermore, the system components of space heat supply and their costs are investigated. A method is developed to establish the supply area belonging to a district heat plant, taking into account the cost of the district heating system and the structural settlement conditions. The book demonstrates the possibilities for applying the method using as an example a particular area of investigation to the east of Karlsruhe, and examines their informative value. It concludes with a model demonstration of how different strategies of extension of the district heating system can be investigated for their efficiency with the aid of the method developed.

25684 **Slow-speed diesel sets cogen records for size, efficiency.** Dunckel, E. *Cogeneration;* 1: No. 5, 13(Nov-Dec 1984).

The first stationary slow-speed diesel cogeneration system in the US is operating at 87% energy efficiency and 90% availability at the Belvidere, NJ, facility of Hoffman-LaRoche, Inc. The system is comprised of a 33,200-hp engine, produced by Sulzer Bros., Ltd. of Switzerland, that is the largest diesel cogeneration engine in the world. The system was designated as a cogeneration demonstration project by the Department of Energy (DOE) which picked up $11.6 million of the project's $25 million cost. DOE had planned to monitor the system for two years to assess its feasibility for broader industrial application. By the end of 14 months, things were operating so smoothly that DOE ended the monitor phase and is now in the process of publishing a report on its operation. The system is an economic success, saving some $4 million a year, is remarkably efficient, and is a feasible approach for industry use.

2910 Conservation

REFER ALSO TO CITATION(S) 25687

25685 **(DOE/NBM—5011054) Energy Conservation and Renewable Resources Program, September 1980.** (USDOE Assistant Secretary for Resource Applications, Washington, DC; Department of Energy, Sacramento, CA (USA). Western Area Power Administration). Sep 1980. 64p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85011054.

As part of the President's June 20, 1979 Solar Energy Message to Congress, he directed the Secretary of Energy, through his Power Marketing Administrators, to develop and implement by September 30, 1980, conservation and renewable resource programs that could serve as models for the electric utility industry. This document is Western Area Power Administration's (Western) response to the President's directive. It is a comprehensive description of the policies, objectives, structure, schedules, and activities that comprise Western's formal Energy Conservation and Renewable Resources Program.

2920 Supply, Demand, And Forecasting

REFER ALSO TO CITATION(S) 25233, 25683, 25692, 25693, 25694, 25716

25686 **(AD-A—150018/0/XAB) Industrial development of Siberia and the Soviet Far East. Interim report.** Pinsky, D.E. (RAND Corp., Santa Monica, CA (USA)). Sep 1984. 90p. (RAND/N—2165-AF). NTIS, PC A05/MF A01.

See also Rept. No. RAND/R-3036-AF, AD-A136 437.

During the 1980s the Soviet leadership will be forced to cope with a growing energy shortage in the western industrialized core of the USSR by accelerating the extraction of fuel and raw materials east of the Urals. The major issue of Soviet policy is and has been the debate over the appropriate nature and pace of economic development for the eastern regions, whether to maintain concentration on the fuel energy complex or to attempt balanced development across industries and between eastern and western regions. Although official declaratory policy continues to call for balanced comprehensive development, the energy-fuel focus has, if anything, increased. Given the general investment constraint the Soviet leadership is now facing, combined with the Soviet leadership's resistance to reform and change, it is unlikely that there will take place the major shift and restructuring of investment for regions east of the Urals that a balanced economic development would require.

25687 **(CONF-8105264—1) Urban renewal and local energy supply.** Volwahsen, A. (Prognos A.G., Basel (Switzerland)). Feb 1983. 37p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE85770195.

From Seminar on urban and regional energy supply concepts; Mannheim, F.R. Germany (18 May 1981).

Local energy supply concepts serve the purpose of integrating energy supply planning with urban development planning. The extension of pipelined heat supply systems, in particular, has to be

harmonized, firstly, with site planning of heat-and-power plants near to consumption and, secondly, with urban renewal planning. The paper explains correlative action mechanisms and describes possible solution steps. The latter comprise microeconomic marginal conditions, consideration of urban structure and renewal process of existing energy supply systems, organization of the planning administrative bodies and consideration of the environmental situation and of the benefits and cost for society.

25688 (EPRI-EA—3816, pp 3.1-3.47) **US energy for the rest of the century: 1984 forecast.** Gustaferro, J.F. (Dept. of Commerce, Washington, DC). Dec 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $22.00. File Number TI85920165. (CONF-8310200—).

From EPRI workshop on forecasting industrial structural change in the USA; Palo Alto, CA, USA (25 Oct 1983).

This paper provides a tabular presentation of the results of recent energy forecasting efforts which extend the work reported on in the publications listed in the bibliography. The energy values presented have been adjusted to reflect data available on US energy consumption in 1983. Therefore, the energy projections for the year 2000 deviate from those in the original documents: they have been adjusted downward to reflect recent consumption trends and changes in the requirement for electrical energy from previously forecast sources, especially nuclear. The basic intent in this presentation is to provide a quantitative feel for the nature of the US energy problem and what this implies for the levels and kinds of energy use we can expect at the end of this century. Thus the reader will not find a detailed description of the analysis underlying the tabular material presented or a specific scenario leading to the forecast projections for the year 2000. The reader should note, however, that the basic assumptions outlined in the referenced forecast remain the same. These include the following: the US standard of living will continue to increase commensurately with an increase in Gross National Product (GNP) (average 2.73% per year); the price of energy will continue to increase at a rate slightly greater than that of inflation.

25689 (EPRI-EA—3816, pp 4.1-4.18) **Shifts in product mix versus energy intensity as determinants of energy consumption in the manufacturing sector.** Samuels, G. Jr.; Vogt, D.P.; Evans, D.M. (Oak Ridge National Lab., TN). Dec 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $22.00. File Number TI85920165. (CONF-8310200—).

From EPRI workshop on forecasting industrial structural change in the USA; Palo Alto, CA, USA (25 Oct 1983).

Changes in industrial energy use in the US in recent years have led to speculation that the country has entered a new phase of development entailing basic structural changes in industrial output, changes that decouple the traditional relationship between gross national product and energy use. The purpose of this paper is to examine the factors contributing to these changes - how much can be attributed to efficiency improvements and/or process changes and how much to changes in the product mix output - and the impact that these changes may have on future energy requirements.

25690 (NP—5770196) **Experience gained with the coordination of heat supply planning and urban renewal planning.** Volwahsen, A.; Oswald, P.; Lutzky, N. (Prognos A.G., Basel (Switzerland)). Dec 1982. 53p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE85770196.

A few general comments on the subject of clashing interests in urban renewal areas are followed by reports on experience gained in two different Berlin districts with old buildings. The paper gives a stock analysis in the heat map, describes the development of various supply strategies and presents concrete results for both Berlin districts. This is followed by an assessment of the supply strategies according to their social tolerability, non-pollutivity, profitability and possible energy conservation. Some final remarks refer to possible methods and means of co-ordinating urban renewal planning and heat supply planning.

25691 (NP—5770267) **Austrian energy balance.** (Oesterreichische Elektrizitaetswirtschafts A.G., Vienna). 1984. 28p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE85770267.

1959 was the first year in which data of the Austrian energy balance were published by the Austrian Institute of Economic Research in cooperation with the Federal Minister of Trade and Reconstruction. The publication is to supplement the official balances of the Central Statistical Office and to give a simplified picture of the mechanisms of the various energy flows. The present study, published as an annex to the 1983 fuel statistics, attempts a detailed outline of Austria's energy balance. In particular, the "substitution" and "equivalence" methods are compared and discussed with a view to their advantages and shortcomings. The statistical and methodological fundamentals of the two methods are critically reviewed in order to gain insight into the effects of the methodology employed on the results obtained in the energy balance.

2930 Policy, Legislation, And Regulation

25692 (CONF-8408155—Pt.1) **Energy Week 1984.** (Energieforum Schweiz, Bern (Switzerland)). 1984. 64p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE85770272.

From Energy week 1984; Zurich, Switzerland (27 Aug 1984).

Published in 3 parts.

Papers read at the 'Energy Week 1984' in Zurich in August 1984 are presented. The lectures dealt with energy policy, energy supply and energy use in Switzerland. The conference was particularly important as it took place immediately before important energy policy decisions were taken on September 23. It was to give a general picture of the energy supply situation and its problems.

25693 (CONF-8408155—Pt.2) **Energy Week 1984.** (Energieforum Schweiz, Bern (Switzerland)). 1984. 52p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE85770273.

From Energy week 1984; Zurich, Switzerland (27 Aug 1984).

Published in 3 parts.

Papers read at the 'Energy Week 1984' in Zurich in August 1984 are presented. The lectures dealt with energy policy, energy supply and energy use in Switzerland. The conference was particularly important as it took place immediately before important energy policy decisions were taken on September 23. It was to give a general picture of the energy supply situation and its problems.

25694 (CONF-8408155—Pt.3) **Energy Week 1984.** (Energieforum Schweiz, Bern (Switzerland)). 1984. 52p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE85770274.

From Energy week 1984; Zurich, Switzerland (27 Aug 1984).

Published in 3 parts.

Papers read at the 'Energy Week 1984' in Zurich in August 1984 are presented. The lectures dealt with energy policy, energy supply and energy use in Switzerland. The conference was particularly important as it took place immediately before important energy policy decisions were taken on September 23. It was to give a general picture of the energy supply situation and its problems.

25695 (DOE/RA/50183—T1) **Onshore permitting systems analysis for coal, oil, gas, geothermal and oil shale leases. Final report.** (Energy Resources Co., Inc., Cambridge, MA (USA)). Sep 1982. Contract AC01-81RA50183. 287p. NTIS, PC A13/MF A01; 1; GPO Dep. File Number DE85010194.

The magnitude and complexity of permit processes raises a question as to their impact on the rate and scope of industrial development activity. One particular area where this issue is of concern is in new energy extraction and development activities. The initiation of new energy projects has been a national priority for several years. But, energy projects, because of their potential for creating land disturbances, are subject to many environmental and

other regulations. Because of this, the permitting required of energy resource developers is extensive. Within the energy field, a major portion of development activities occurs on federal lands. This is particularly true in the Rocky Mountain states and Alaska where the principal landholder is the federal government. The permitting requirements for federal lands' development differ from those for private lands. This report assesses the impact of permitting processes for energy resource development on federal lands. The permitting processes covered include all of the major environmental, land-use, and safety permits required by agencies of federal and state governments. The lands covered include all federal lands, with emphasis on eight states with major development activities.

25696 **(DOE/RG/10219—T1) PURPA grant program. Final progress and financial report, October 1, 1979-December 31, 1981.** (Ohio Public Utilities Commission, Columbus (USA)). 1 Mar 1982. Contract FG01-79RG10219. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85009405.

The general purpose of this project was to provide an independent analysis of the efficiency of various lifeline rate structures in meeting various target populations. The project required the development of analytical techniques and the utilization of these techniques to evaluate the desirability of lifeline rates. The analysis not only evaluated various lifeline proposals but also considered the relationship between lifeline rate structures and the existing Ohio Energy Credits Program.

25697 **(DOE/RG/10399—T1) [Status of the Mississippi Public Service Commission's consideration of thirteen FERC standards based on a PURPA program grant]. Final program report, October 1, 1980-December 31, 1981.** Howle, C.K. (Mississippi Public Service Commission, Jackson (USA)). 31 Dec 1981. Contract FG01-80RG10399. 13p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85009351.

A description of the status of the six major project activities that were planned to be accomplished by the Mississippi Public Service Commission is provided. The main focus was to provide public hearings for local reactions to the Public Utility Regulatory Policies Act.

25698 **(GAO/RCED—85-54) Clearer EPA superfund program policies should improve cleanup efforts.** Bowsher, C.A. (General Accounting Office, Washington, DC (USA). Office of the Comptroller General). 6 Feb 1985. 26p. General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877. File Number TI85901368.

The Environmental Protection Agency (EPA) responds to the release or threatened release of hazardous substances into the environment through its Superfund removal and remedial programs. This report focuses on the Superfund removal program at the nation's worst hazardous waste sites. EPA limits removal actions to preventing or mitigating immediate and significant risk to humans or the environment so that an inordinate share of the Superfund budget would not be used on less significant sites. This policy, however, inhibits EPA in the permanent, long-term cleanup of waste sites. It has resulted in the worst hazardous waste sites receiving only stopgap cleanups, leaving hazardous substances on the surface and requiring repeated stopgap actions at additional cost. EPA has proposed policy changes that would allow more thorough surface cleanup at sites. GAO agrees with this change but recommends that EPA include in its policy revision a requirement that removal actions eliminate surface hazardous substances to the extent possible to reduce recurring threats, avoid repeated actions, minimize Superfund expenditures, and contribute to the permanent remedy of hazardous waste sites.

2940 Fossil Fuels

REFER ALSO TO CITATION(S) 25178, 25179, 25180, 25217, 25233, 25233, 25233, 25234, 25235, 25235, 25240, 25254, 25712, 25714

25699 **(BNL—35955-Vol.1) Model documentation of the gas analysis modeling system. Volume 1. Model overview.** Kydes, A.S. (Brookhaven National Lab., Upton, NY (USA)). Aug 1984. Contract AC02-76CH00016. 48p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85010952.

This is Volume 1 of three volumes of documentation for the Gas Analysis Modeling System (GAMS) developed by the Analysis and Forecasting Branch, Reserves ad Natural Gas Division, Office of Oil and Gas, Energy Information Administration (EIA), US Department of Energy. The documentation has been developed to comply with the requirements specified in Energy Information Administration Order EI 5910.3A, Guidelines and Procedures for Model and Analysis Documentation, effective October 1, 1982. Volume 1 is intended to satisfy the requirements of paragraph 5.c(3) of the Order, "Model Overview". The Appendix A provides a model abstract which is intended to satisfy the requirements of 5.c(1) of the Order. This document is a non-mathematical description of the GAMS system, and is written for an audience with a technical understanding of applied statistical/applied mathematics modeling. Companion volumes to Volume 1 include: Volume 2 - Model Documentation of the Gas Analysis Modeling System: Model Methodology; Volume 3 - Model Documentation of the Gas Analysis Modeling System: GAMS Software, Data Documentation and User's Guide. 6 figs., 1 tab.

25700 (EPRI-EA—3816, pp 6.1-6.23) **Changing industrial market: the role of gas-fired cogeneration.** Hedman, B.A.; Oates, G.K.; Kelly, R.W.; Willke, T.L. (Gas Research Institute, Chicago, IL). Dec 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $22.00. File Number TI85920165. (CONF-8310200—).

From EPRI workshop on forecasting industrial structural change in the USA; Palo Alto, CA, USA (25 Oct 1983).

The Gas Research Institute (GRI), in order to develop a comprehensive research and development program, continually assesses the competitive forces influencing the market demand for energy. The industrial sector is of particular importance since it is the largest energy-consuming sector in the US. As well as being the largest gas consumer, the industrial sector is currently the most uncertain market for natural gas. As the era of extensive industrialization based on low-cost energy draws to a close, evidence suggests that the position of natural gas as the favored industrial fuel is threatened. The first section of this paper briefly examines recent energy consumption trends in industry, with particular attention focused on natural gas and electricity. The second section and the major portion of this paper will illustrate why GRI considers cogeneration as one of the ways in which natural gas can remain competitive in the evolving US manufacturing market. This paper will identify some of the applications, industries, and regions where gas-fired cogeneration could have the greatest impact given an environment where interfuel competition will surely intensify.

2960 Electric Power

REFER ALSO TO CITATION(S) 25403, 25404, 25689, 25696, 25697, 25714

25701 **(DOE/EI/19635—1) Trends in electric utility load duration curves.** (Resource Dynamics Corp., McLean, VA (USA)). Dec 1984. Contract AC01-83EI19635. 159p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85011451.

This report documents the development and analysis of annual and quarterly load duration curves for each of the 10 Federal regions. The report describes analyses performed to test for changes in load duration curve shapes over time. These analyses are intended to aid the electric utility analyses and modeling activities of the Energy Information Administration (EIA) by expanding the understanding of current and expected load duration curve shapes. 7 figs., 13 tabs.

25702 **(DOE/EIA—0226(85/01)) Electric Power Monthly, January 1985.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). Apr 1985. 43p. NTIS, PC A03/MF A01 - GPO; GPO Dep. File Number DE85010007.

During January 1985, net generation by electric utilities in the United States was 227,733 gigawatthours (GWh). On a year-to-date basis, net generation at the end of January 1985 was 5.1% higher than for the same period in 1984. In January 1985, coal accounted for 56.7% of all electricity produced, petroleum for 5.3%, gas for 9.7%, hydroelectric power for 12.1%, nuclear power for

15.9%, with the remaining 0.4% from geothermal, wood, wind, waste, and solar. In January 1985, electric utilities consumed 63,629 thousand short tons of coal. Petroleum consumption in January 1985 was 21,052 thousand barrels, while gas consumption was 224,873 million cubic feet. On a year-to-date basis, coal consumption at the end of January 1985 was 5.7% higher than that for the same period in 1984; petroleum consumption was 21.8% lower than during the same period in 1984; and gas consumption was 4.6% higher. Electric utilities' end-of-month coal stocks for January 1985 were 167,524 thousand short tons, 6.8% less than in December 1984. Coal stocks at the end of January 1985 were 12.1% more than stocks at the end of January 1984. End-of-month petroleum stocks for January 1985 were 82,057 thousand barrels, 6.3% less than stocks in December and 6.8% less than stocks a year ago.

25703 (EPRI-EA—3816, pp 1.1-1.17) **EPRI perspective on industrial electricity use.** Gupta, P.C.; Faruqui, A. (Electric Power Research Institute, Palo Alto, CA). Dec 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $22.00. File Number TI85920165. (CONF-8310200—).

From EPRI workshop on forecasting industrial structural change in the USA; Palo Alto, CA, USA (25 Oct 1983).

The relevance of forecasting US industrial structural change in the resource planning process of electric utilities is discussed. It is shown that changes due to international trade competition and new technologies significantly impact the forecasts of US industrial energy use. A framework for analyzing future electricity use which takes into account these factors is presented.

25704 (EPRI-EA—3816, pp 2.1-2.19) **Recent effects on electricity demand of the changing composition and structure of US industrial production.** Marlay, R.C. (Dept. of Energy, Washington, DC). Dec 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $22.00. File Number TI85920165. (CONF-8310200—).

From EPRI workshop on forecasting industrial structural change in the USA; Palo Alto, CA, USA (25 Oct 1983).

Changes in the composition and structure of US industrial production in the last decade have had a significant effect on electricity demand. These changes and associated effects are examined with a view toward developing a methodology for predicting future industrial electricity demand.

25705 (EPRI-EA—3816, pp 5.1-5.8) **Effect of industrial structure on the demand for electricity: myth or reality?.** Sutherland, R.; Drake, R. (Los Alamos National Lab., NM). Dec 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $22.00. File Number TI85920165. (CONF-8310200—).

From EPRI workshop on forecasting industrial structural change in the USA; Palo Alto, CA, USA (25 Oct 1983).

It is suggested that changes in the industrial structure in the last two decades have had a minor influence on the total demand for electricity and that future changes may also have a minor influence. An econometric model using aggregate variables such as price of electricity, gross national product, and population seems to best explain trends in electricity use.

25706 (EPRI-EA—3816, pp 7.1-7.23) **Changing demands and technologies: their potential impacts on electricity.** Cronin, F.J.; Currie, J.W.; Moe, R.J.; Adams, R.C.; Wusterbarth, A.R. (Battelle-Pacific Northwest Lab., Richland, WA). Dec 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $22.00. File Number TI85920165. (CONF-8310200—).

From EPRI workshop on forecasting industrial structural change in the USA; Palo Alto, CA, USA (25 Oct 1983).

The Battelle-Northwest Economic Modeling System was used to evaluate the effects of industrial structural and technological changes on electric energy consumption in the US. Some conclusions drawn from the study are discussed.

25707 (EPRI-EA—3816, pp 8.1-8.7) **Future of electricity supply for the US (dinner presentation).** Chiles, J.H. III. (Bechtel Power Corp., San Francisco, CA). Dec 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $22.00. File Number TI85920165. (CONF-8310200—).

From EPRI workshop on forecasting industrial structural change in the USA; Palo Alto, CA, USA (25 Oct 1983).

The problems in the electric utility industry which were identified in a Department of Energy study on future electricity supplies are discussed. Some of the conclusions drawn from that study as well as responses to those conclusions are also mentioned. Some recommendations for solving the problems are presented.

25708 (EPRI-EA—3816, pp 9.1-9.24) **Industrial electricity demand: prospects and uncertainties.** Werbos, P.J. (Dept. of Energy, Washington, DC). Dec 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $22.00. File Number TI85920165. (CONF-8310200—).

From EPRI workshop on forecasting industrial structural change in the USA; Palo Alto, CA, USA (25 Oct 1983).

Energy Information Administration studies on industrial energy demand are discussed with an emphasis on electricity use. Some conclusions regarding factors influencing industrial electricity demand are presented and implications for future demand are examined.

25709 (EPRI-EA—3816, pp 10.1-10.18) **Perspectives on structural change in manufacturing.** Humphrey, B.G.; Bauer, D.C. (Edison Electric Institute, Washington, DC). Dec 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $22.00. File Number TI85920165. (CONF-8310200—).

From EPRI workshop on forecasting industrial structural change in the USA; Palo Alto, CA, USA (25 Oct 1983).

The evolution of the sectoral composition of the economy with an emphasis on manufacturing is discussed and its implications for the future of the electric power industry are examined. Historical changes are reviewed and recent trend changes are interpreted. It is concluded that structural changes have had a relatively small effect on electricity consumption in the manufacturing sector.

25710 (EPRI-EA—3816, pp 11.1-11.21) **Future industrial electrification and productivity.** Bergman, M.K.; Leber, E. (American Public Power Association, Washington, DC). Dec 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $22.00. File Number TI85920165. (CONF-8310200—).

From EPRI workshop on forecasting industrial structural change in the USA; Palo Alto, CA, USA (25 Oct 1983).

The relationship between industrial electricity use and productivity is examined. The role of electric power in improving the total systemic efficiency of energy use is noted. Human factors influencing technology growth are also discussed.

25711 (LALP—84-54) **Future market for electric generating capacity: a summary of findings.** Sutherland, R.J.; Drake, R.H. (Los Alamos National Lab., NM (USA)). Dec 1984. Contract W-7405-ENG-36. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010352.

The results of an assessment of the market for new electric generating capacity with particular focus on the United States market until the year 2000 are presented. The characteristics of generating plants that are needed to penetrate the market are determined through their effect on the financial health of the buyer. Current problems facing the market are shown to be institutional rather than technological.

25712 (NP—5770268) **Networked energy supply economy in France - development, structure and problems.** Eickhof, N.; Prohaska-Reichenbacher, M. (Bamberg Univ. (Germany, F.R.)). 1982. 67p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE85770268.

By means of substantial nationalization of enterprises, the French state has created for itself pathways and tools for directly influencing this sector of energy economy in order to succeed with the aims of its energy policy - viz., above all 'consumer supply at lowest national-economic cost' and 'supply security'. In addition, some further objectives of economic and social policies are to be implemented in key sectors of national economy by means of public enterprises. Market structure is highly concentrated in both the

electricity and gas sectors: production, transport and distribution of power are encumbent on the state enterprise Electricite de France (EDF) - apart from minor exceptions. Transport and distribution of gas is implemented predominantly by the state company Gaz de France (GDF). The state-owned (up to 70%) oil company Elf-Aquitaine is charged with the task of natural gas extraction. Quite apart from the remainder of energy economy which is largely subjected to state control, too, the French state at present influences more than 42% of final energy consumed in France via EDF and GDF alone. In this respect, France differs fundamentally from the Federal Republic of Germany in the sector of networked energy supply so that the question of comparison springs to the mind.

2980 Consumption And Utilization

REFER ALSO TO CITATION(S) 25183, 25719

25713 **(DOE/CE—0015/4) Annual report to the Congress and the President on industrial energy efficiency improvement, 1983.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC. Office of Industrial Programs). Apr 1985. 76p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85011692.

In 1983, manufacturing industry improved its energy efficiency 3.8% beyond that achieved during 1982. Since 1972, the cumulative energy efficiency improvement reported by the industrial sector through calendar year 1983 was 26.2%. The cumulative efficiency improvement for firms reporting with a base year of 1972 was 26.3%. Those firms reporting in the program with a base year of 1978 had a cumulative improvement of 23.6%. The 1972 base year improvement figure was 5.5% higher than the percent reported in 1981, and 8.6% higher than the 1980 level. As energy efficiency in the industrial sector has increased during the 1980s, energy consumption has decreased. Total reported energy consumption in 1983 for the 20 Standard Industrial Classifications encompassed by this report was 11.1 quadrillion Btu. Since 1972, industrial consumption of natural gas and coal has decreased significantly, with consumption of electricity and coke increasing only slightly. During that same period, oil usage also declined.

25714 **(DOE/EIA—0376(82)) State Energy Price and Expenditure Report, 1970-1982.** (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). Apr 1985. 525p. NTIS, PC A22/MF A01; 1 - GPO; GPO Dep. File Number DE85010678.

Estimated average energy prices and expenditures are provided for each year from 1970 through 1982 for the United States, each of the 50 States, and the District of Columbia. Estimates are provided by energy type (coal, natural gas, petroleum products, nuclear, wood/waste at electric utilities, and electricity) and by economic sector (residential, commercial, industrial, transportation, and electric utilities). Documentation on how the estimates were developed is provided, including sources of data, methods of estimation, notes on conversion factors, and a section describing changes in methodology since the previous report. Sources for completed documentation of the prices and expenditures, a glossary, and an appendix listing cases of regional price imputation are given.

25715 **(IIES-dp—83-11) Consumer energy research.** Joerges, B. (Wissenschaftszentrum Berlin (Germany, F.R.). Internationales Inst. fuer Umwelt und Gesellschaft). 1983. 258p. Wissenschaftszentrum Berlin (Germany, F.R.). Internationales Inst. fuer Umwelt und Gesellschaft.

This bibliography lists 2752 publications on energy consumption in private households of the period between the late seventies and the early Eighties. The citations are listed in alphabetic order. Eight countries are covered: The USA, the United Kingdom, France, the Netherlands, Sweden, Greece, Australia, and the Federal Republic of Germany.

25716 **(PB—85-150118/XAB) Factors affecting the composition of energy use in developing countries. Discussion paper.** Dunkerley, J.; Knapp, G.; Glatt, S. (Resources for the Future, Inc., Washington, DC (USA)). Dec 1981. 115p. NTIS, PC A06/MF A01.

To help redress the problem posed by the escalating substitution in developing countries of oil and other commercial fuels for traditional energy sources, this study examines present and projected energy use in those countries. After an initial review of trends in major energy use over the past 30 years, an examination is made of energy supply (including energy prices and energy resources); factors affecting energy demand (changing energy use in the major end-use sectors, the reasons for the changes, and structural changes in the economy), and the effects of government policies on energy consumption. A summary of the study's findings and implications stresses the need to complement future government policy efforts to find substitutes for oil with coordinated efforts in regard to energy prices, supply, and major end-use sectors.

2990 Unconventional Sources And Power Generation

REFER ALSO TO CITATION(S) 25447, 25513, 25685

25717 **(ANL/CNSV-TM—128) Uniform cost-estimation method for biomass production and conversion technologies.** (Argonne National Lab., IL (USA)). Jan 1985. Contract W-31-109-ENG-38. 94p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85011714.

One of the challenges of managing an energy research and development (R and D) program is to develop consistent and reliable estimates of technology costs. Estimates from different sources often conflict, and underlying assumptions are seldom consistent. In response to this problem, the Biomass Energy Technology (BET) Division of the US Department of Energy (DOE) has devised, with the help of Argonne National Laboratory (ANL), a uniform cost-estimating and reporting method for all biomass production and conversion technologies. This report summarizes that procedure and provides worksheets with full instructions, along with three sets of worked examples. This guide has been developed for a variety of purposes and users. First, it will be used by BET field managers and contractors to estimate the costs of BET-sponsored technologies. Second, it is designed to meet the needs of industry, by providing potential biomass energy developers and producers with a consistent method for comparing costs of biofuel technologies with those of other energy technologies. 6 figs., 12 tabs.

25718 **(DOE/NBM—5011577) Renewable energy research and development outlook. Volume 1.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC). Feb 1985. 43p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85011577.

This evaluation has provided a consistent method to evaluate and select R and D activities that preferentially select high payoff, effective activities with a well-defined federal role. When the selected activities are aggregated into budget categories, each technology area has clearly identified R and D directions. These results have already been used in the multiyear planning process by DOE, and will continue to provide a basis for program directions from within DOE, from the laboratories supporting DOE, and from those industries actively supporting research and development or renewable energy systems.

25719 (MRI/SOL—1101, pp 367-374) **Solar energy applications in Chile: the storage problem.** Alvarado, S. (Univ. of Chile, Santiago). 1982. NTIS, PC A19/MF A01. File Number DE84015232. (CONF-820312—; SERI/CP—270-1521).

From Solar storage workshop; Jeddah, Saudi Arabia (21 Mar 1982).

After a summary description of the country's energy profile and solar energy resources, potential, and main applications (in operation, planned, and under study), the storage problem is discussed. Solar storage is analyzed from the national perspective (although some considerations may prove equally valid for other countries) under the following topics: Is there a real need for solar storage?; accumulation required (short, medium, and long term); storage systems: local experience and interests and systems under consideration; and research requirements. The relevant conclusions are that many actual solar applications do not necessarily demand storage, but for other applications, storage is an attractive or even a

mandatory proposition. For the near and intermediate future, short- and medium-term storage seems more important than seasonal accumulation.

25720 (PB—85-156081/XAB) Wood use: US competitiveness and technology. Volume 2. Technical report. (Office of Technology Assessment (U.S. Congress), Washington, DC). Nov 1984. 103p. (OTA-M—224). NTIS, PC A06/MF A01.

See also PB84-109925. Library of Congress Catalog Card No. 83-600567.

The final report of this assessment was published as Volume I of Wood Use: US Competitiveness and Technology. Volume II reviews the status of wood manufacturing technology and surveys the current and future uses of wood products. It explores the existing or developing technologies and manufacturing processes that can enable the United States to benefit from its vast timber resource.

30 DIRECT ENERGY CONVERSION

3001 Mhd Generators

25721 (DOE/ID/01745—T5) [MHD generator CDIF]. Quarterly technical progress report, January 1-March 31, 1985. (Mountain States Energy, Inc., Butte, MT (USA)). 1985. Contract AC07-78ID01745. 24p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85011389.

The Component Development and Integration Facility (CDIF) is a major US Department of Energy magnetohydrodynamic (MHD) test facility in Butte, Montana. The CDIF is operated by Mountain States Energy, a Division of MSE, Inc. The CDIF is responsible for performing integration testing of vendor-supplied MHD power train components to support the goal of commercialization. During the second quarter of FY 1985, the facility was operated to support Coal System testing and processing. First-stage, coal-fired combustor (CFC) characterization testing was completed and data analysis was initiated. Areas of progress included: Coal System operation; test bay modifications; plant availability enhancement; 1A channel refurbishment; independent test activity; coal-fired combustor (CFC) characterization testing; and preparation for power generation. 14 figs.

3005 Fuel Cells

REFER ALSO TO CITATION(S) 25099, 25666, 25667

25722 (CONF-850511—1) Molten carbonate fuel cell cathode material development. Kucera, G.H.; Minh, N.W.; Smith, J.L.; Mrazek, F.C. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010268.

From Fuel cell seminar; Tucson, AZ, USA (19 May 1985).

The evaluation of possible alternative cathode materials has been the principal molten carbonate fuel cell activity at Argonne National Laboratory. The focus of the effort has been on examining the effect of synthesis and sintering environment on materials properties and on understanding the mechanisms of conduction. In the current study, materials are synthesized under a range of typical cathode gas compositions at 1- and 10-atm pressure. The resultant product(s) are examined by x-ray diffraction analysis to determine nominal crystal structure, phases, and the lattice constants of the unit cell. To understand the mechanisms of conduction, a characterization of electrical conductivity is needed. This requires that charge type, charge carrier concentration, and charge mobility be determined as a function of temperature, composition, and gaseous environment. Because these quantities can't be completely determined by direct experimentation, several different types of experimental measurements must be used in combination with theoretical interpretation. Tests are currently run to elucidate the type of electronic defects under various gas compositions. The in-cell behavior of undoped candidate materials was evaluated by migration testing. Information on the net effect of cathode solubility and the stability of the dissolved species in the anode environment was obtained principally by posttest analysis of the electrolyte structure. 2 tabs.

25723 (DOE/FE/60338—15) Phosphoric acid electric utility fuel cell technology development. Technical progress report No. 15, July 1984. Breault, R.D.; Briggs, T.A.; Congdon, J.V.; DeMarche, T.E.; Gelting, R.L.; Goller, G.J.; Luoma, W.L.; McCloskey, M.W.; Mientek, A.P.; O'Brien, J.J. (United Technologies Corp., South Windsor, CT (USA). Power Systems Div.). 1984. Contract AC21-83FE60338. 48p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85011751.

Over 400 hours have been accumulated with performance close to the E-line goal on the second 10-ft², 28-cell stack. Two subscale cells cut from 10-ft² electrodes of the same batch as used in the second 10-ft² 28-cell stack performed at the E-line goal after 1500 hours. Over 12,300 hours and 34 thermal cycles have been accumulated on the 3.7-ft², 30-cell stack at 120 psia and 405°F. Cooler processing time was significantly reduced. Multiple cooler subassemblies were processed in the same press cycle. 17 figs., 7 tabs.

25724 (DOE/MC/20212—1739) Effects of H_2S on molten carbonate fuel cells. Progress report, April 1-June 30, 1984. Remick, R.J. (Institute of Gas Technology, Chicago, IL (USA)). Mar 1985. Contract AC21-83MC20212. 87p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85008310.

This report summarizes work accomplished to identify the poisoning mechanism(s) responsible for performance losses of molten carbonate fuel cells (MCFC) when operating on sulfur-containing gases. This objective is being addressed by focusing out-of-cell and in-cell experiments on single mechanistic issues, followed by incorporation of the results into a model that correlates cell potential decline to contaminant(s) concentration. When coupled with gas cleanup cost projections, the model can be used to conduct trade-off studies leading to the selection of optimum feed-gas compositions for MCFC power plants. The importance of this program is that the degree to which H_2S and other contaminants must be removed from typical MCFC fuels can have a profound effect on the cost of cleaning the fuel gas, especially if contaminant levels lower than 0.1 ppM are required. The anticipated product from the overall program is a justifiable specification for gas cleanup requirements for MCFC power plants. The loss in performance experienced by fuel cells operating on contaminated fuels has been traced to the electrochemical formation of a layer of nickel sulfide on the fuel cell electrode. This layer forms as the result of a reaction between the nickel electrode and dissolved sulfide ions in the electrolyte, not as the result of a nickel/hydrogen sulfide interaction as previously supposed. A formula was derived that can be used to calculate the potential at which this layer can form based upon local gas phase concentrations. This formula provides a satisfactory explanation of the results observed in the half-cell experiments and can be applied to various performance models to calculate the conditions at which the onset of performance losses would occur. However, this formula by itself does not provide enough information to allow the performance of a partially contaminated cell to be modeled. Appendix A has been entered separately. 26 refs., 4 figs., 3 tabs.

25725 (DOE/MC/20212—1739, pp A.1-A.26) **Two-dimensional model of H_2S adsorption on nickel fuel cell electrodes for a study of effects of H_2S on molten carbonate fuel cells.** Bartholomew, C.H.; Hsieh, H.Y. (Bartholomew Consulting Services, Orem, UT). Mar 1985. NTIS, PC A05/MF A01. File Number DE85008310.

In Effects on H_2S on molten carbonate fuel cells. Progress report, April 1-June 30, 1984.

The initial approach to the modeling of H_2S adsorption on nickel electrodes used simplified equilibrium and nonequilibrium models involving one spatial dimension (z) and one temporal dimension (t). Adsorption was modeled using the equilibrium adsorption isotherm of Alstrup et al. The results indicated that less than saturation adsorption occurs on nickel electrodes at the high-temperature operating conditions (650°C, 1 atm) typical of molten carbonate cells. The initial calculations showed that H_2S concentration and adsorbed sulfur gradients would be present in the electrode along the z direction, the steepness of which depended on the rate of mass transfer between the bulk gas phase and the nickel surface.

Unfortunately, attempts to model the effects of H_2S on the water-gas-shift reaction using this simplified, one-dimensional (1-D) model revealed some important inadequacies. Thus, it was clear that development of a two-dimensional (2-D) model was necessary. The 2-D model of H_2S adsorption on a nickel electrode described in this report is an extension of the 1-D treatment and is similar to the film-pore diffusional model introduced by Selman. The model enables prediction of H_2S concentration and surface sulfur loading profiles along the cell length (z direction) and into the electrode pore (x direction) as a function of time. The results indicate that the profiles of H_2S concentration and adsorbed surface sulfur on the nickel electrode depend on: (1) k/sub ml/, the film mass transfer coefficient for H_2S between the bulk gas phase and the outer surface of nickel electrode; and (2) on k/sub m2/, the mass transfer coefficient between H_2S in the pores of the electrode and the solid electrode surface surrounding the pores. This report includes the description of a computer program to solve the model equations, sample calculations, and a listing of the program. 4 refs., 17 figs.

25726 **(DOE/MC/20400—1751) F-CAP documentation.** (Mueller Associates, Inc., Baltimore, MD (USA)). Oct 1984. Contract AC21-83MC20400. 333p. NTIS, PC A15/MF A01; 1; GPO Dep. File Number DE85003369.

Fuel cell power plants, which are currently under development, have many positive attributes including the potential to generate electricity at substantially higher efficiencies and with lower adverse environmental impacts than alternative systems. They also are projected to provide efficient part-load operation, fast power response time, cogeneration potential, and siting and fuel flexibility. Fuel cells show promise of being used in a wide range of sizes and applications. Near-term applications are expected to include electric utility power plants of multimegawatt size on cyclic and intermittent duty as well as industrial and commercial applications of power plants of similar sizes where the electrical output and thermal output can both be advantageously used. These power plants are expected to operate on natural gas and/or naphtha-type fuels, but later fuel cells are expected to operate on fuels derived from coal and other non petroleum resources. Large plants may include integrated coal gasification units. Other applications under evaluation include cogeneration and on-site systems in the residential, commercial, and industrial sectors and even transportation. To date, many analyses of the actual benefits of multimegawatt size fuel cell power plants have relied upon crude estimates of system performance. Further, no hardware demonstrations of commercial size units have occurred to date. As a result, the power plant system performance information normally required to conduct a technical and economic analysis of the viability of a power plant system for specific applications does not exist. An objective of the computer model developed in this study is to enable estimates to be made of fuel cell performance and economics under a variety of operating conditions and applications.

25727 **(DOE/METC—85/10) F-CELL: the ASPEN fuel cell model.** Regenhardt, P.A. (EG and G/Washington Analytical Services Center, Inc., Morgantown, WV (USA)). Mar 1985. Contract AC21-81MC14521. 235p. NTIS, PC A11/MF A01; GPO Dep. File Number DE85001975.

This report documents the fuel cell model created at the Morgantown Energy Technology Center for systems simulations that use the Advanced System for Process Engineering (ASPEN) simulator. The report includes: (1) an explanation of the thermodynamics involved, (2) an explanation of the efficiencies used to describe and compare a fuel cell, (3) the FORTRAN code and ASPEN system definition file entries required to install the model into the ASPEN system, (4) three sample ASPEN input files demonstrating how the model could be used for phosphoric acid, molten carbonate, and solid oxide fuel cells, (5) a detailed ASPEN input file that simulates a commercial 40-kW phosphoric acid fuel cell system, and (6) the technical and the user entries for the ASPEN manuals. F-CELL is designed to use the results of either a mechanistic model or experimental data to model a fuel cell in a system study. A double set of efficiencies is produced; the first is calculated from the user's input, and the second is based on ASPEN's results. The second set of efficiencies serves as a check on the input data and is not used in any internal calculations. The model also checks for carbon deposition. If a suitable set of equations is ever developed, the model is capable of determining the fuel cell life based on the concentration of contaminating species. 6 refs.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

25728 **(BG-Trans—6380) Fuel-value boilers: essential to have the authorities' goodwill.** Genath, B. Translated from *Sanitaer - Heizungstechnik ;* No. 3, 255-259(1983). 22p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85901122. DE85901122

"Fuel-value" boilers are sure to be one of the focal points on the boiler industry's stands at the forthcoming ISH. These are gas boilers which, while still extracting the heat of condensation from the flue gases, use this technique - together with one or two other refinements - to achieve an overall efficiency which is 20 to 25% better than conventional gas-circulation heating systems. What types are there to choose from and where do their strengths and weaknesses lie. There is one point which should be made at the outset: without the goodwill of the authorities, it's going to be a long haul getting them through the building regulations.

3201 Buildings

REFER ALSO TO CITATION(S) 25455, 25461, 25471, 25477, 25481, 25658, 25715, 25837, 26064, 26065, 26066, 26067, 26068, 26069, 26070, 26071, 26082

25729 **(BMFT-FB-T—84-280) Design of an information system that registers continuously the energy-use of private households with regard to the determinants and providing user-oriented reports.** Liepelt, K.; Wiesner, W. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Technischer Ueberwachungs-Verein Rheinland e.V., Koeln (Germany, F.R.)). Dec 1984. 362p. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE85751607.

The report documents the design of an information system providing new information services about the energy-use of private households and its physical, behavioural and economic determinants. The concept is based on a technical system which continously measures energy-flows for a representative panel of households and buildings. Priority was given to develop a cost-effective technical measuring system and for transmission, storage and analysis of the data in a network connected to a central computer. This was including market-investigations about appropriate technical features, sensors etc. and laboratory tests of the measurement-concept. The system design for sensoring, preprocessing and storing the data generated within the building was also developed to provide for transmission of the data by the telephone-network to a central computer and for producing information services based on these data. In addition, results of in-depth interviews and technical investigations in a larger sample of households and its buildings are presented. Results proved the technical and methodological feasibility of this project.

25730 **(BNL—36151) Seasonal effects on multi-zone air infiltration in some typical US homes using a passive perfluorocarbon tracer technique.** Dietz, R.N.; D'Ottavio, T.W.; Goodrich, R.W. (Brookhaven National Lab., Upton, NY (USA)). Feb 1985. Contract AC02-76CH00016. 8p. (CONF-850804—1; BNL-tr—1044). NTIS, PC A02/MF A01; GPO Dep. File Number DE85009762.

From World congress on heating, ventilating and air conditioning--international exhibition; Copenhagen, Denmark (25 Aug 1985).

The time-averaged air infiltration (I), exfiltration (E), and between-zone exchange rates in three, similarly sized, 2-story homes with basements were measured biweekly for one year with the passive PFT system. In February, total air changes per hour (ACH) were 0.20, 0.29, and 0.69 h^{-1}, respectively, for houses D, B, and G, but total air flow in and out of the basements were in the ratio of about 1:4:7, respectively. House D had an average 1st floor ACH/sub I/ of 0.32 and ACH/sub E/ of 0.50 h^{-1} and, for the 2nd floor, 0.02 and 0.05 h^{-1}, respectively; this house only needed slight weath-

erization on the 1st floor. Floor 1 in and out rates in B were 0.27 and 0.03 h^{-1}, and for floor 2, 0.07 and 0.45 h^{-1}, respectively, indicating a slight weatherization need. The house G 1st floor ACH/sub I/ and ACH/sub E/ were 0.72 and 0.35 h^{-1} and 2nd floor, 0.00 and 1.21 h^{-1}, respectively, showing a need for significant weatherizing. Total seasonal ACH was correlated with temperature difference and wind speed within +-12% for all 3.

25731 **(BNL—36186) Errors resulting from the use of single zone ventilation models on multi-zone buildings: implications for energy conservation and indoor air quality studies.** D'Ottavio, T.W.; Dietz, R.N. (Brookhaven National Lab., Upton, NY (USA)). Feb 1985. Contract AC02-76CH00016. 34p. (CONF-850606—4). NTIS, PC A03/MF A01; GPO Dep. File Number DE85010548.

From American Society of Heating, Refrigerating and Air-Conditioning Engineers' semiannual meeting; Honolulu, HI, USA (23 Jun 1985).

Errors resulting from treating a house as an enclosure surrounding a single, well-mixed volume of air are explored in detail for a ranch house with a basement. A fairly typical ventilation pattern is assumed and three quantities, the air exchange rate, the indoor pollutant concentration from a given emission, and the energy required to heat infiltrating air, are calculated and compared using both the one and two zone models for this house. In general, the errors were around 10 to 20% if the basement was included in the one zone models and 30 to 40% if the basement was neglected. Other factors that affect the magnitude of these errors include the length of a pollutant release, the outdoor temperature and the air exchange rate measurement protocol as well as the particular ventilation characteristics of the house. 8 refs., 8 figs., 2 tabs.

25732 **(CONF-820849—) What works: documenting energy conservation in buildings.** Harris, J.; Blumstein, C. (eds.). (Lawrence Berkeley Lab., CA (USA); American Council for an Energy Efficient Economy, Berkeley, CA). 1984. Contract AC03-76SF00098. 597p. NTIS, PC A25/MF A01; 1; GPO Dep. File Number DE84014927.

From Summer study in energy efficient buildings; Santa Cruz, CA, USA (22 Aug 1982).

Separate abstracts were prepared for individual papers. (MHR)

25733 **(CTH-JVG—12) Surface soil heat in clay for 88 houses at Surte. Effects on the soil.** Wilen, P. (Chalmers Inst. of Tech., Goeteborg (Sweden). Earth Heat Pump Group). Oct 1983. 51p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. File Number DE85750871.

88 one family houses at Surte have been equipped with horizontal surface soil heat pumps. The collector coils are buried 0.8-1.0 m deep with 1.0-1.5 m distance. Each heat pump is fitted with a 300 m coil. Two of these systems were studied in detail, including ground temperatures. The measurements show that the coils move in the clay, but no sign there of have been noted on the surface. Only a small zone around the coils freeze during winter. 300 m of coil seems to be sufficient during winter. The mean power extracted during heat pump operation is 17.5 W/m coil for the period January-March, with a heat medium temperature of -1C degree and a 30-45 % operator time.

25734 **(CTH-JVG—13) Horizontal pipe systems in soil for heating and cooling of single family houses.** Rhen, I.; Sundberg, J.; Wilen, P. (Chalmers Inst. of Tech., Goeteborg (Sweden). Earth Heat Pump Group). May 1984. 58p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85750890.

In this study the possibilities are examined for using a heat pump, connected to a horizontal pipe system in the ground, for both heating and cooling. Climate and ground conditions from Minnesota, USA have been used in the study. A finite difference program has been used for several calculations. The influence of different heat extraction rates, pipe configurations and different soil conditions have been studied. The report includes a description of the heat pump system and basic factors. Conclusions from the calculations are presented as well as a short economic analysis of the system.(author).

25735 **(DOE/BP/13795—1) End-Use Load and Conservation Assessment Program (ELCAP): commercial sector sample design.** Baker, M. (Pacific Northwest Labs., Richland, WA (USA)). Apr 1984. Contract AC06-76RL01830;AC79-83BP13795. 52p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85011512.

This report describes the commercial building sample design for the Bonneville Power Administration's (BPA) End-Use Load and Conservation Assessment Program (ELCAP). The sample has been designed to meet a number of the program's research objectives, specifically those related to forecasting and conservation assessment. Data on hourly end-use loads and building characteristics will be collected from the sample; these data will provide a basis for understanding the current and future patterns of end-use electricity consumption for a wide variety of commercial buildings found in BPA's service area. The design includes the selection of two samples, both confined to the area served by Seattle City Light (SCL). One sample is used to represent the entire population of commercial buildings. This sample has been chosen from a listing of commercial tax parcels. The other sample is used to represent the population of buildings that have been built under the Seattle Energy Code. This sample was chosen from a listing of new construction permits provided by the Seattle Department of Construction and Land Use. The samples selected provide a list of candidate sites for hourly end-use data collection. A two-stage, stratified random sampling procedure was used to select candidate sites from the listing of commercial tax parcels. In the first stage of the procedure, 1052 parcels were selected from 11 building types. The probability of selection (sample proportion) for buildings in each stratum was proportional to regional electrical energy use for each building type. The building types, along with the sampling proportions, are shown below. Each tax parcel was assigned to one of these building types based on the tax assessor's land use classifications.

25736 **(DOE/CE/30749—T3) Site handbook: data acquisition system information, Princeton Professional Park, Princeton, NJ.** Frey, D.J.; Holtz, M.J. (Architectural Energy Corp., Westminster, CO (USA)). Jan 1985. Contract AC02-82CE30749. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010910.

The Princeton Professional Park is composed of three buildings. Each of these buildings has a long, narrow atrium running along the east/west axis with individual tenant office spaces connected to the atrium from the north and south. The atrium is used to collect heat which can be used by the tenants, it provides natural light, and is the circulation space for entering he offices. Each of the tenant spaces is served by its own electrical service, separate from the other spaces. Each tenant space has its own mechanical systems. These mechanical systems are integral components of the passive/hybrid systems. Each tenant space has at least two heat pumps. The mechanical system can operate in 10 modes for heating, cooling, ventilating, and charging or discharging a rock bed. A channel log is provided which includes the description, location, and units for each of the 33 data channels monitored. One-time measurements are listed, as well as a sample output. A file log includes the file name, the beginning and ending times of each file, and comments regarding discontinuities in the data.

25737 **(DOE/CS/30229—T1) Determination of the maximum beneficial window size for single family residences: component residential influences. Final report.** (CCB/CUMALI Associates, Oakland, CA (USA)). 23 Oct 1981. Contract FG03-80CS30229. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010817.

This report was prepared by CCB/CA to further assist in understanding the comprehensive parametric runs previously accomplished for NFC. The results verify the significance of the utilization of sun control devices in controlling the residence cooling load with increasing window size. Likewise, large magnitude differences were shown to exist based on the particular equations used in defining infiltration and slab loss/gains. Conclusions are as follows: (1) Previously generated data represent a concrete approach to the control of the cooling load and thus, to the variation of energy use with window size. (2) For certain residential double and triple pane primary window orientations, it is possible to reduce energy use by

increasing the window size when using sun control devices. However, without solar reduction techniques in force, one can expect an increase in energy usage with increased window size. (3) Residential components which do not affect the solar radiation gain (i.e., internal loads, infiltration, night insulation, ventilation, wall/floor/window conductance), have a small effect on the thermal load/window size slope. Thus, algorithmic variations of these parameters which yield different thermal load magnitudes will not influence definition of an optimum window size. (4) Continuing studies should concentrate on techniques which can be used to reduce the cooling load, particularly through solar radiation control. Overhang structures, roller shades, reflective blinds, etc. need to be more thoroughly investigated and quantified. 5 refs., 6 figs.

25738 (DOE/R3/02410—T1) **Evaluate underground water pipes as a heat source/sink for residential heat pumps. Final report.** Bartlett, J.V. Jr. (Bartlett (James V., Jr.), Myersville, MD (USA)). Sep 1982. Contract FG43-80R302410. 59p. NTIS, PC A04. File Number DE85008995.

The work done under this project included digging approximately 1,200 linear feet of trenches about twelve feet deep, preparing a bottom foundation of sand, laying PVC pipe loops, and backfilling with sand and then soil. The loops were manifolded in the basement of the home. Temperature and flow meters then allow calculation of the heat energy extracted from each loop by the heat pump.

25739 (DOE/R3/06097—T1) **Passive vent damper. Final report.** Savery, C.W. (Savery (C. William), Portland, OR (USA)). 15 Sep 1981. Contract FG43-79R306097. 51p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85009168.

Seven concepts upon which a passive vent damper device could be based were generated during the early phase of the project. The concepts are: von Karman vortex street phenomena, turbulence amplifier in parallel with flow over a body, flow stability with heat transfer effects, temperature dependent flow oscillation effects, temperature controlled jet deflection, vortex valve, and separation phenomena to reduce drag. After the fluid mechanical approach to developing a passive vent damper was exhausted, the outside combustion vent was identified as a passive concept related to vent dampers which is amenable to development. Calculations and literature search indicated that up to 10% fuel savings were possible with an outside combustion vent. A breadboard design of a residential system was generated; one was constructed; and a field test with the investigator's forced air furnace was conducted. Based upon tests, the outside combustion vent produced energy savings of 0.4×10^6 Btu/month. This was estimated to result in about $30.00 seasonal fuel savings. The design, during a total of about 20 hours of operation in the field, operated safely and reliably with no problems. The outside combustion vent was proved feasible, and to have adequate performance, reliability, safety and economics. The few steps remaining to complete the commercialization of the device as a conversion for installed and new furnace applications are identified and outlined.

25740 (EPRI-EA/EM—3824, pp 3.1-3.10) **Air exchange in buildings.** Harrje, D.T. (Princeton Univ., NJ). Jan 1985. Research Reports Center, Box 50490, Palo Alto, CA 94303 $23.50. File Number TI85920206. (CONF-8403172—; CONF-8405169—). Contract AC02-77CS20062.

From Indoor air quality seminar - implications for electric utility conservation programs; Atlanta, GA, USA (6 Mar 1984).

The impact of energy conservation programs on air exchange in buildings is examined. Ventilation standards, methods of measuring air exchange, and the effects of recent trends in building construction and weatherization on air exchange rates are discussed.

25741 (EPRI-EA/EM—3824, pp 5.1-5.13) **Air infiltration, energy use, and indoor air quality in EPRI test houses. Part I. Infiltration and energy use.** Nagda, N.L. (GEOMET Technologies, Inc., Rockville, MD). Jan 1985. Research Reports Center, Box 50490, Palo Alto, CA 94303 $23.50. File Number TI85920206. (CONF-8403172—; CONF-8405169—).

From Indoor air quality seminar - implications for electric utility conservation programs; Atlanta, GA, USA (6 Mar 1984).

Two houses of identical design, one retrofitted for tightness and with an air-to-air heat exchanger, were monitored for energy use, air infiltrations, and indoor air quality. This paper describes the study design and the measurement procedures and reports some of the air infiltration and energy measurements.

25742 (EPRI-EA/EM—3824, pp 6.1-6.14) **Air infiltration, energy use, and indoor air quality in EPRI test houses. Part II. Indoor air quality.** Nagda, N.L. (GEOMET Technologies, Inc., Rockville, MD). Jan 1985. Research Reports Center, Box 50490, Palo Alto, CA 94303 $23.50. File Number TI85920206. (CONF-8403172—; CONF-8405169—).

From Indoor air quality seminar - implications for electric utility conservation programs; Atlanta, GA, USA (6 Mar 1984).

Two houses of identical design, one retrofitted for tightness and with an air-to-air heat exchanger, were monitored for energy use, air infiltration, and indoor air quality. Results of indoor air quality measurements are reported here and the combined impact of infiltration on energy use and indoor air quality is discussed.

25743 (EPRI-EM—3797, pp 5.1-5.23) **Heat pump testing and rating in the US: problems and successes.** Tree, D.R. (Purdue Univ., Lafayette, IN). Nov 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $17.50. File Number TI85920174. (CONF-840266—).

From Heat pumps: an update on research and applications seminar; New Orleans, LA, USA (23 Feb 1984).

Part of the Energy Policy and Conservation Act of 1975 mandated that the US Department of Energy (DOE), with technical input from the National Bureau of Standards (NBS), identify classes of equipment that use large amounts of energy and develop procedures to measure and/or predict the seasonal energy used by this equipment. Each piece of equipment was to be labeled with a seasonal energy usage or seasonal energy efficiency and the cost per year to operate such equipment. Unitary air conditioners and heat pumps were selected as one class of equipment to be so labeled. From this developed the so-called DOE test procedures for unitary air conditioners and heat pumps. This paper discusses: (1) the development of the test procedure, (2) recommended changes being made in the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) proposed Standard 116 and the Air-Conditioning and Refrigeration Institute (ARI) Standards 210 and 240, (3) problems in getting repeatability, and (4) how the test procedure predicts the energy usage in the field. This paper only deals with single, constant-speed compressor heat pumps.

25744 (EPRI-EM—3797, pp 6.1-6.5) **Ground-source heat pumps: an overview.** Purcell, G. (Electric Power Research Institute, Palo Alto, CA). Nov 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $17.50. File Number TI85920174. (CONF-840266—).

From Heat pumps: an update on research and applications seminar; New Orleans, LA, USA (23 Feb 1984).

This brief overview on ground source heat pumps presents not so much a technical status report as it gives insight as to who's currently active in this research, with some insight as to the important research and development issues being pursued. Also presented are the implications for what needs to be researched.

25745 (EPRI-EM—3797, pp 10.1-10.7) **EPRI heat pump field performance testing.** Hiller, C.C. (Electric Power Research Institute, Palo Alto, CA). Nov 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $17.50. File Number TI85920174. (CONF-840266—).

From Heat pumps: an update on research and applications seminar; New Orleans, LA, USA (23 Feb 1984).

The Electric Power Research Institute (EPRI) has been sponsoring field performance testing of improved or novel heat pump concepts since the late 1970s, for the purpose of making performance benefits more sidely known to utilities and the public, and to help identify research and development needs for improving modeling, cycles, equipment, and systems. The present paper emphasizes the following four recent studies: field performance moni-

toring of split air-to-air multizone heat pump system, monitoring of improved air-source heat pumps, monitoring of central and room heat pumps, and crawlspace earth-coupled heat pump experiments.

25746 (EPRI-EM—3797, pp 11.1-11.19) **Update on heat pump reliability.** Lovvorn, N.C. (Alabama Power Co., Birmingham). Nov 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $17.50. File Number TI85920174. (CONF-840266—).

From Heat pumps: an update on research and applications seminar; New Orleans, LA, USA (23 Feb 1984).

Actual service histories, as experienced in typical homes, are charted in relation to time to show frequencies of the various service categories. Data accumulated by four manufacturers for ten years are evaluated in this report, with two reporting periods per year from 1974 through 1983. Some 10,000 heat pumps were a part of this evaluation. The categories evaluated are as follows: refrigerant components, compressor motor circuits, fans, indoor blower motor failures, outdoor fan motor failures, defrost circuit, thermostats, indoor and outdoor, supplemental heaters, refrigerant leaks, and compressor failures.

25747 (EPRI-EM—3797, pp 12.1-12.5) **Advanced central heat pump development.** Hudelson, G.D. (Carrier Corp., Syracuse, NY). Nov 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $17.50. File Number TI85920174. (CONF-840266—).

From Heat pumps: an update on research and applications seminar; New Orleans, LA, USA (23 Feb 1984).

In late 1982, the Electric Power Research Institute (EPRI) and Carrier Corporation undertook a contract to develop an Advanced Heat Pump for application as a central unitary system in residential and light commercial buildings circa 1990. The overall objective of the project is to develop and demonstrate a heat pump that offers significantly improved performance, favorable load characteristics to utilities, and economic and comfort benefits to consumers. The project to date has been principally engaged in determining whether or not the goals are technically feasible and what the effect could be relative to the manufacturer, the utilities, and the user, with and without introduction of an Advanced Heat Pump. The work accomplished to date has produced the results described.

25748 (EPRI-EM—3797, pp 15.1-15.9) **Heat exchanger requirements for potable water protection.** Marciniak, T.J. (Fauske and Associates, Inc., Burr Ridge, IL). Nov 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $17.50. File Number TI85920174. (CONF-840266—).

From Heat pumps: an update on research and applications seminar; New Orleans, LA, USA (23 Feb 1984).

One area which has been identified as unnecessarily adding to the cost of water-source heat pumps, heat reclaim desuperheaters, auxiliary and double-bundle condensers, and heat pump water heaters is the requirement for double-wall separation between the refrigerant and potable water systems. This requirement is usually embodied in building, plumbing and mechanical codes as well as product standards and environmental regulations. The main issue addressed in this project is whether or not double-wall separation is needed to protect the public from harm if refrigerant or compressor oils were to infrequently contaminate potable water because of heat exchanger failure.

25749 (EPRI-EM—3797, pp 17.1-17.5) **Manufacturers' perspectives on heat pump development.** Nov 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $17.50. File Number TI85920174. (CONF-840266—).

From Heat pumps: an update on research and applications seminar; New Orleans, LA, USA (23 Feb 1984).

As part of the seminar, a panel consisting of four manufacturers' representatives engaged in a discussion with members of the audience on the status of heat pump technology and the outlook for the future. Panelists from the Trane Company, Friedrich Air Conditioning and Refrigeration Company, and Honeywell, Inc. submitted statements which are presented.

25750 (EPRI-EM—3797, pp 2.1-2.7) **Overview of EPRI heat pump research.** Calm, J.M. (Electric Power Research Institute, Palo Alto, CA). Nov 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $17.50. File Number TI85920174. (CONF-840266—).

From Heat pumps: an update on research and applications seminar; New Orleans, LA, USA (23 Feb 1984).

A major objective of the Electric Power Research Institute (EPRI) program in electric energy end-use technologies for the residential sector is to develop more economical and reliable heat pump equipment and systems. The main goals of the Residential and Commercial Heat Pump Subprogram are: 1) to develop advanced heat pump equipment and systems: 2) to examine advanced concepts and cycles for heat pumps; and 3) to monitor and assess new applications of heat pumps. Efforts toward attainment of each goal are briefly discussed.

25751 (EPRI-EM—3797, pp 3.1-3.9) **EEI heat pump programs.** Van den Berg, A.J. (Edison Electric Institute, New York, NY). Nov 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $17.50. File Number TI85920174. (CONF-840266—).

From Heat pumps: an update on research and applications seminar; New Orleans, LA, USA (23 Feb 1984).

Topics discussed include: heat pump marketing overview, research and development, promotion and publicity, regulatory activities, appliance efficiency standards, and tax credits for heat pumps.

25752 (EPRI-EM—3797, pp 4.1-4.8) **Marketing program for add-on heat pumps.** Bowers, W. (Philadelphia Electric Co., PA). Nov 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $17.50. File Number TI85920174. (CONF-840266—).

From Heat pumps: an update on research and applications seminar; New Orleans, LA, USA (23 Feb 1984).

The Philadelphia Electric Company (PECo) is a combination utility serving gas, electricity, and steam in the city of Philadelphia. PECo is involved in a marketing program for the promotion of heat pumps and, particularly, add-on heat pumps for residential buildings. Their marketing approach and successful results are the topic of this paper.

25753 (EPRI-EM—3797, pp 7.1-7.3) **Monitoring of residential groundwater heat pumps.** Freedman, G.M.; Mohre, D.L. (Allegheny Electric Cooperative, Inc., Pittsburgh, PA). Nov 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $17.50. File Number TI85920174. (CONF-840266—).

From Heat pumps: an update on research and applications seminar; New Orleans, LA, USA (23 Feb 1984).

The objective of this project was to determine the performance and economics of residential groundwater heat pumps in the Northeast region. Two groundwater heat pumps were installed in residences in central Pennsylvania in climates of more than 6000 heating degree days. Both heat pumps refrigerate supply water via a refrigeration cycle to heat air in a forced-air distribution system. Both units were retrofit into forced-air fossil-fuel-fired heating systems. Electric furnace units were installed to conveniently measure backup heat requirements and for calibration. The test period was two heating and cooling seasons, 1981-83. Test results are summarized.

25754 (EPRI-EM—3797, pp 8.1-8.12) **Ground-coupled heat pump tests.** White, J.W.; Parker, J.D. Nov 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $17.50. File Number TI85920174. (CONF-840266—).

From Heat pumps: an update on research and applications seminar; New Orleans, LA, USA (23 Feb 1984).

The Electric Power Research Institute and Oklahoma Gas and Electric Company (OG and E) jointly funded the research project. The test results were to determine if it were possible to reduce both summer and winter demand on the utility systems as a benefit to the utility and reduce energy usage to the consumer for the utility customer's benefit. The test began with the construction of three identical houses of 1233 ft^2 designed as typical energy effi-

cient speculative homes that are found in the OG and E service area. The three homes were situated side by side, with the fronts facing north. The east house was equipped with an air-to-air heat pump, the middle house with a ground-coupled/solar assist heat pump, and the west house with a ground-coupled only heat pump. Conclusions are: 1) The ground-coupled system has reduced demand compared to the air-to-air system during utility peak periods in the actual test as well as in the simulation. 2) Supplemental resistance back-up heat was not required for the ground-coupled system except during an emergency situation for maintenance. 3) The U-tube coupling device operated without problems for the final year of the project. 4) The U-tube ground-coupled system used 29% energy on an annual basis than did the air-to-air system. Simulations to normalize performance showed annual savings of 25% on the ground-coupled system compared to the air-to-air system with similar loads.

25755 (EPRI-EM—3797, pp 9.1-9.5) **Evaluation of ground-source heat pump performance.** Braud, H.J. (Louisiana State Univ., Baton Rouge). Nov 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $17.50. File Number TI85920174. (CONF-840266—).

From Heat pumps: an update on research and applications seminar; New Orleans, LA, USA (23 Feb 1984).

Rising energy prices appear to be a certainty in the near future. Although temporary reduction in oil prices has given some relief to homeowners who use oil for heat, there is no foreseeable relief for electric and natural gas users. Closed-loop water-source heat pump systems have the energy-saving advantage inherent in water-source heat pumps and there are no water supply or disposal problems. These systems draw on the constant temperature of the earth mass for a heat source in winter and the relatively cool temperature of the earth for a heat sink in summer. Research in earth heat transfer rates has led to the design of vertical-bore and horizontal-grid plastic pipe heat exchangers for heat pumps. Different pipe configurations have been evaluated, and several designs are now being used by contractors who are in the business of installing earth-source heat pump systems in Louisiana.

25756 (EPRI-EM—3797, pp 13.1-13.12) **Compressors for heat pumps.** Shaw, D.N. Nov 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $17.50. File Number TI85920174. (CONF-840266—).

From Heat pumps: an update on research and applications seminar; New Orleans, LA, USA (23 Feb 1984).

The compressor is the heart of the heat pump. It must intake vapor generated by the system evaporator and compress and pump this vapor into the system condenser. This paper reviews the compression demands of wide range heat pumps and then goes on to explain what is needed to properly meet the new application requirements. It then discusses the suitability of various types of compressors and drives for heat pumps of the future.

25757 (EPRI-EM—3797, pp 14.1-14.9) **Heat pump water heaters.** Calm, J.M. (Electric Power Research Institute, Palo Alto, CA). Nov 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $17.50. File Number TI85920174. (CONF-840266—).

From Heat pumps: an update on research and applications seminar; New Orleans, LA, USA (23 Feb 1984).

Heat pump water heater technology, commercial availability, benefits, history, field test results, installation and operation, consumer acceptance, and performance ratings are discussed. Future acceptance of heat pump water heaters will depend on energy prices, equipment cost reductions, efficiency improvement and consumer awareness and understanding of this option.

25758 (EPRI-EM—3797, pp 16.1-16.9) **Overview of DOE-sponsored heat pump research.** Fairchild, P.D. (Oak Ridge National Lab., TN). Nov 1984. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $17.50. File Number TI85920174. (CONF-840266—).

From Heat pumps: an update on research and applications seminar; New Orleans, LA, USA (23 Feb 1984).

Department of Energy (DOE) research activities related to residential and commercial heat pump technology are supported by the Office of Building Energy Research and Development, Building Equipment Division (under the DOE Assistant Secretary for Conservation and Renewables). Technical management is assigned to the Oak Ridge National Laboratory (ORNL), located in Oak Ridge, Tennessee. In-house expertise at ORNL is used to identify and evaluate R and D opportunities, to conduct selected research tasks, and to assist DOE in managing contracted activities. Program planning is coordinated with the Electric Power Research Institute (EPRI) and benefits from active interaction with equipment manufacturers and utilities. More than half of the project funding is passed through to contractors, most of which are industrial organizations.

25759 **(EPRI-EM—3919-CCM) EMPS-2.1 computer program for residential building energy analysis: user's manual.** Merriam, R.L.; Rancatore, R.J. (Little (Arthur D.), Inc., Cambridge, MA (USA)). Apr 1985. 310p. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303. File Number TI85920614.

A comprehensive computer program, EMPS 2.1, has been developed for the analysis of residential building thermal loads, space conditioning and water heating energy use. The program consists of three modules: (1) a building energy analysis program; (2) an economics analysis program; and (3) an hourly weather tape processor. The energy analysis program is capable of multiple space analysis with central and/or unitary space conditioning systems including: furnace, one- or two-stage air-air heat pump, ground-coupled heat pump, room dehumidifier, mechanical ventilation. Both time clock controlled and utility controlled (supervisory load managed) operation of the systems may be simulated. The electric water heating systems are: conventional, time clock controlled, active solar, dedicated heat pump and heat recovery (desuperheat). The energy analysis program has been designed to be a highly flexible research tool. The economic analysis program provides a capability to evaluate time-of-day energy and demand rate schedules and to perform a simplified utility cost of service determination. TMY or SOLMET format data files may be used to prepare EMPS compatible weather tapes. Support in the use of the program is available to members of the EMPS User's Group and through an Electronic Bulletin Board.

25760 **(NP—5770198) Gas-filled double glazing.** Goesele, K.; Schuele, W.; Lakatos, B. (Forschungsgemeinschaft Bauen und Wohnen, Stuttgart (Germany, F.R.)). 1982. 4p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE85770198.

On the basis of the results of experiments the sonar and thermal properties of insulated double glazing filled with gas are tested. The sound insulation properties of double glazing can be improved by introducing a gas of a heavy specific weight, such as CO_2 or SF_6 into the hollow space. Even gases with a light specific weight produce an improvement in sound insulation; light gases diffuse outwards much more rapidly, however, and can thus be eliminated for practical purposes. The combination of a gas-filled space between the panes and the use of sufficiently heavy compound panes were tested. The thermal properties of insulated double glazing filled with specifically heavy gas gave favourable results with a lower heat transition coefficient. The use of gas to fill double glazing has a particularly favourable effect if the panes are given a heat-reflecting coating in synthetic frames.

25761 **(NP—5770199) Determination of temperature and heat flow conditions in a hot-water underfloor heating system in a lightweight construction single-family house.** Oswald, D. (Forschungsgemeinschaft Bauen und Wohnen, Stuttgart (Germany, F.R.)). 1982. 4p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE85770199.

In a single-family house of lightweight construction with a heavy underfloor heating system, experimental studies were carried out to see whether an agreeable climate could be achieved. Depending on the external temperature, statements were made on the time schedule for the indoor temperature and indoor temperature distribution, the heat transmission coefficient and heat given off by the underfloor heating, the ease of regulation etc. Among other things it was found that difficulties were encountered in the adjustment of the desired indoor temperature if the flow temperature reg-

ulation is only controlled on the basis of the outdoor temperature. With zone valves or thermostatic valves, the indoor temperature can be adjusted and maintained. The heat given off from the floor is sufficient even on the coldest days of the year. The heat losses of the unheated rooms below the underfloor heating depend on the total heat given off. On average they amounted to over 30%. By means of a 6 cm thick additional insulating layer, a reduction to under 20% was achieved.

25762 **(ORNL/Sub—81-22201/3) Issue of sky conditions.** Gillette, G.; Treado, S. (National Bureau of Standards, Washington, DC (USA)). Apr 1985. Contract AC05-84OR21400. 32p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85010590.

The issue of sky conditions is explored as applied to current daylighting practice. Based on studies of hourly sky conditions in the Washington, DC area an understanding was sought regarding the ability to estimate illuminances and sky luminances under skies of variable cloudiness. The meaning and validity of non-standard, non-perfect skies is discussed, and limits of non-perfection are explored and compared against meaurements of hourly sky luminance, illuminance, and solar radiation.

25763 **(PNL-SA—12995) Building industry roundtable on technology transfer and research utilization: proceedings.** Achenbach, P.R.; Seaton, W.W. (American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, GA). Apr 1985. Contract AC06-76RL01830. 78p. (CONF-841258—Summ.). NTIS, PC A05/MF A01; GPO Dep. File Number DE85011348.

From ASHRAE/DOE round table on technology transfer; Washington, DC, USA (12 Dec 1984).

A roundtable on technology transfer and research utilization for energy conservation in buildings was conducted by the American Society of Heating, Refrigerating and Air-Conditioning Engineers as a part of the needs assessment program in research utilization of the Department of Energy. About 35 selected experts from a broad spectrum of building community organizations met in Washington, DC, to identify the constraints, discontinuities, limitations and inadequacies in the present technical information dissemination procedures and to recommend new or improved procedures and the means for carrying them out. Some of the more important recommendations of the panels reflected the need for: organized collection and reformatting of technical information for designers and builders; greater participation by DOE staff in introducing research results into handbooks and good practice guidelines; early involvement of industry representatives in planning, evaluating and monitoring research programs to stimulate interest and acceptance of output; incorporation of technology transfer objectives in the initial planning of research programs; greater DOE support for university research and for all aspects of technology transfer; preparation of more comprehensive bibliographies of technical information and computerization of the data base; and support of "proof of concept" projects to bridge the gap between laboratory research results and building practice.

25764 **(SERI/TP—251-2660) Patching the thermal hole of windows.** Potter, T.F. (Solar Energy Research Inst., Golden, CO (USA)). Apr 1985. Contract AC02-83CH10093. 8p. (CONF-850301—6). NTIS, PC A02/MF A01; GPO Dep. File Number DE85008795.

From 12. annual energy technology conference and exposition; Washington, DC, USA (25 Mar 1985).

Materials research is being applied to the significant reduction of undesired heat gains and losses through apertures. This paper summarizes the background and recent progress supporting the development of vacuum and electrochromic windows at SERI. Evacuated glazings now under investigation feature a thin-film, transparent infrared reflector, spherical glass spacers, and laser-welded edges. We believe that these features will result in an overall glazing R-value of 10 or more, maintainable over architectural lifetimes. Technical issues discussed include thermal and mechanical stress, optimal spacer configuration, and gaseous diffusion. The electrochromic work has concentrated on achieving large differences in the transmissivity of window glazing by using thin, transparent films that respond to small electrical potential by becoming, reversibly, partially colored or opaque. Color memory, bleaching rates, and alternative transparent solid-state conductors are discussed.

3202 Transportation

REFER ALSO TO CITATION(S) 25195, 25673, 25676

25765 **(NP—5770279) Investigation of fuel- and cost saving investments in road construction.** Kurzak, H. (Forschungsvereinigung Automobiltechnik e.V., Frankfurt-am-Main (Germany, F.R.)). 1984. 174p. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number DE85770279.

Between 1970 and 1981 the total milage of all vehicles in the Federal Republic of Germany increased by 38%, at the same time the length of the total road surface only grew by 10%. The average traffic density has increased. Effects: longer driving time, increased fuel consumption and consequently an increased burden on economy. Apart from an extension of the road net which is not always possible, the traffic flow can be improved by optimising the existing road net. During the investigations described here the new draft for the 'Directives for road construction, Part: Investigating the economy' was screened, the functions used were adapted and the data were brought up to date. Based on this approach concrete road construction measures were carefully investigated. Comprehensive cost-analyses took into account not only the savings for the national economy by reduced fuel consumption by also the shorter driving time and reduced staff cost. In the case studies made here it was possible to indicate the profitability limit for the respective road construction measures depending on traffic density. Result: economically reasonable extensions of the road net of the Federal Republic of Germany have an energy saving potential of about 1 million tons of fuel/year and costs of 1,8 thousand million DM. These possibilities of optimising our road net should be used in the interest of our economy.

3203 Industry And Agriculture

REFER ALSO TO CITATION(S) 25201, 25674, 25689, 25700, 25703, 25704, 25705, 25706, 25708, 25709, 25710, 25713, 25776, 25961, 26079

25766 **(CONF-8410167—Summ.) Scrap tire fuel for cement kilns. Exchange meeting summary .** Dodds, J. (comp.). (EG and G Idaho, Inc., Idaho Falls (USA)). 1984. Contract AC07-76ID01570. 50p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85011259.

From Scrap tire fuel for cement kilns; Chicago, IL, USA (2 Oct 1984).

The objective of this meeting was to discuss how to implement the use of waste tires as a partial substitute fuel in the US manufacture of cement. The meeting stimulated interest between cement kiln operators and tire recyclers to use waste tires as a partial fuel substitute and established communication between tire recyclers and cement manufacturers. Waste tires are being used in cement kilns in Germany, England, Canada, and Japan. DOE's purpose in conducting the meeting was to identify an appropriate DOE role to reduce the apparent barriers currently inhibiting the use of waste tires in the US cement industry.

25767 **(DOE/CE/40539—01) Development of a coal/water slurry-fueled diesel engine for industrial cogeneration. Task 2.0 topical report: fuel preparation, beneficiation and handling.** (Thermo Electron Corp., Waltham, MA (USA). Energy Systems Div.). Mar 1984. Contract AC02-82CE40539. 108p. NTIS, PC A06/MF A01; GPO Dep. File Number DE85010443.

Report TE4319-40-84.

This is part of a program whose objective is to establish a high efficiency prototype industrial power system that can burn coal directly. The power system consists of a slow-speed, two-stroke diesel engine and a fuel preparation system which provides clean micronized coal in a water slurry for use as the primary fuel. The project is divided into five tasks. This topical report deals with the subject of Task 2: Fuel Preparation, Beneficiation and Han-

dling. The first part of the report consists of a comparative evaluation of the beneficiation technologies that can reduce the ash content in the coal to less than 1%, and a comparative analysis of the most important factors affecting the economics of these processes as a whole. The second part is a report of the slurry procurement effort and the preliminary screening tests that were performed on the slurries to determine which ones will be used for the diesel engine tests scheduled to commence in July 1984 in a single-cylinder test engine facility located at the Sulzer Bros. Ltd., plant in Winterthur, Switzerland.

25768 **(IS—4874) Direct utilization - recovery of minerals from coal fly ash. Fossil Energy Program. Technical progress report, 1 July 1984-30 September 1984 including summary of work for FY84.** Burnet, G.; Murtha, M.J.; Benson, J.D. (Ames Lab., IA (USA)). Mar 1985. Contract W-7405-ENG-82. 89p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85011292.

The research discussed in this report deals with resource recovery from coal conversion solid wastes. Progress is reported on two methods (the HiChlor and Lime-Sinter processes) for extracting metal values from power plant fly ash. Preliminary work is also reported on a method of making cement from the residue of the lime-sinter process. In the HiChlor Process, metal oxides in the fly ash are converted to volatile chlorides by reaction with chlorine in the presence of a reductant. Several versions of this approach are being investigated. The Lime-Sinter Process utilizes a solid state reaction to selectively convert the alumina in fly ash to a soluble form. Fly ash is mixed with limestone and a suitable mineralizer (to reduce the temperature required for sintering and to enhance alumina recovery) and then sintered in a high temperature kiln. Alumina is recovered by leaching the resulting clinker. A complex relationship between the calcium, alumina, silica, and sulfur constituents in the feed mixture controls the formation and extraction of aluminate compounds. Alumina recovery levels are enhanced by promoting the formation of less-soluble calcium compounds and/or more-soluble aluminum compounds. A study is underway to determine the degree to which flue gas scrubber sludge can be used both as a limestone substitute and as a sulfur bearing mineralizer. Results show that 20 to 25% of the limestone can be provided by the scrubber sludges. 25 refs.,25 figs., 10 tabs.

25769 **(NP—5770275) Possibilities for energy conservation by means of vegetation heating during the cultivation of vegetables under glass and foil.** Schrottmaier, J.; Nadlinger, M. (Bundesanstalt fuer Landtechnik, Wieselburg (Austria)). Jul 1983. 31p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE85770275.

The traditional high pipe heating is the most wasteful type of greenhouse heatings and has, in addition to the price, all disadvantages that can be thought of. Therefore, the pipes are increasingly installed near the plants, in most cases even directly into the flower beds and are called vegetation heating. Thus the heating becomes effective at the spots where it is needed which saves fuel costs. In the case of vegetables growing in single-glazed greenhouses there is a 25% saving against single-glazed greenhouses with pipe heating. Especially cost-saving are double foil houses with a vegetation heating where savings of 50% can be anticipated against single-glazed houses with pipe heatings, without having to take additional heat insulating measures. As far as possible from the planting-technical point of view a double foil house combined with a vegetation heating would be the energetically ideal solution for growing vegetables. Vegetation heating has a positive impact on the growth of the plants and the plants are, in general, healthier.

25770 **(NP—5770281) Investigations on the use of electrically- and combustion-engine-operated compressor heat pumps for greenhouse heating.** Klein, F.J. (Hannover Univ. (Germany, F.R.). Inst. fuer Technik in Gartenbau und Landwirtschaft). 1984. 264p. (In German). NTIS (US Sales Only), PC A12/MF A01 . File Number DE85770281.

Description of the essential result of tests made with compression heat pumps for green house heating, one of them was operated by an electric motor and three by combustion engines. The operational results achieved with these four demonstration pumps are compared with statements of literature on the utilization of such system, an evaluation follows. Simulation models are set up for the optimation of heat pump systems for greenhouse heating. These mathematical models are based on meteorological data collected over many years for the sites Trier, Hannover and Munich. The results of these calculations and the relations described could be a helpful working basis for designing heat generation system when it comes to the planning of heat pumps for greenhouse heating. They can also provide a basis for the calculation of the economy of heat pumps and the comparison with other heating energy generators and thereby help to avoid unrealistic calculations as were often made in the past years.

25771 **(PB—85-127678/XAB) Energy efficiency in the steel industry with emphasis on developing countries. Technical paper.** Meunier, M.Y.; de Bruyn Kops, O. (International Bank for Reconstruction and Development, Washington, DC (USA)). 1984. 91p. NTIS MF A01.

Library of Congress catalog card No. 84-10424.

The recent experience of the industrialized countries has shown that energy costs per unit of output of steel can be reduced significantly through a variety of measures ranging from energy management and improvement of operating conditions through better housekeeping, to more capital-intensive investments in modifications to existing plant and equipment and conversion to more energy-efficient processes. The report aims at a broad presentation of concepts, measures and issues relevant to achieving such improvements in energy efficiency in the steel industry based on experience in both industrialized and developing countries.

3206 Municipalities And Community Systems

REFER ALSO TO CITATION(S) 25175, 25681, 26108, 26112, 26113, 26126, 26127, 26128, 26167

25772 **(CONF-8303106—) Sewage sludge - raw material or pollutant.** Boehnke, B. (Technische Hochschule Aachen (Germany, F.R.). Gesellschaft zuer Foerderung der Siedlungswasserwirtschaft). 1984. 797p. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE85770201.

From 16. Essen meeting on sewage sludge - raw material or pollutant; Essen, F.R. Germany (9 Mar 1983).

Those lecturing at the conference make a valuable contribution towards solving the problem of sewage sludge and keeping the ground and surface water clean. 27 papers have been subject-analysed separately.

25773 (CONF-8303106—, pp 33-50) **Sewage sludge composting - experiences made in Baden-Wuerttemberg.** Wolf, G. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE85770201.

From 16. Essen meeting on sewage sludge - raw material or pollutant; Essen, F.R. Germany (9 Mar 1983).

Following a short review on the state of sewage sludge composting in Baden-Wuerttemberg, an experiment of practical value is discussed showing the possibility of composting sewage sludge with straw on stacks with the help of a special device. The process is characterized by a relatively low technical effort and also by a feasible solution to the utilization of sewage sludge in rural areas.

25774 (CONF-8303106—, pp 51-65) **Sewage sludge composting.** Eggink, H.J. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE85770201.

From 16. Essen meeting on sewage sludge - raw material or pollutant; Essen, F.R. Germany (9 Mar 1983).

The composting of sewage sludge is an important method of stabilisation, in addition to sludge digestion and aerobic sludge mineralisation. After composting the final product almost totally loses its initial character, is without odours, has a grainy structure (can be disseminated) and has a solid content of 60 - 70%. Primary and excess sludge as well as digested or aerobically stabilised sewage sludge can be composted. For one and a half years large scale experiments towards composting of fresh sludge are being carried out in Eindhoven. The results and experiences gathered from these experiments are presented. Limiting factors for the efficient operation of a composting plant are homogeneous mixture of sludge and

wood shavings; adequate aeration of the clamps and elimination of climatic influences. One ton of sludge solid substance (corresponds to about 4t belt press cake) provides approximately 2.5 t compost. From the financial viewpoint, the composting of sewage sludge is particularly interesting in case the sludge has to be dewatered to high solid matter content due to unsatisfactory settling properties and in case only an insufficient sludge digestion has been installed.

25775 (CONF-8303106—, pp 67-107) **Sewage sludge treatment and disposal - experiences made in Japan.** Kubo, T. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE85770201.

From 16. Essen meeting on sewage sludge - raw material or pollutant; Essen, F.R. Germany (9 Mar 1983).

This paper describes the present status of sewage sludge treatment and ultimate disposal in Japan, and then experiences in automated control, mechanical dewatering, incineration and composting in the field of sewage sludge treatment and ultimate disposal in Japan are described. Some of the techniques have been put into practice and some of them are still under experiment or are being evaluated.

25776 (CONF-8303106—, pp 143-171) **Optimized sewage sludge evaluation through energy utilization.** Meyer, H. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE85770201.

From 16. Essen meeting on sewage sludge - raw material or pollutant; Essen, F.R. Germany (9 Mar 1983).

Sewage sludge should be utilized in agriculture as a fertilizer or for soil improvement. If digestion is used for sludge stabilisation, the value of sewage sludge can be increased by generation of a current. The theoretical energy potential of sewage sludge is adequate to the total energy consumption of sewage treatment plants, but experience has proved that the generation of biogas is often more expensive than purchasing from the power station. The most important foundations are shown which guarantee an economical design and operation of biogas generation on sewage treatment plants; costs of investment and operation are specified.

25777 (CONF-8303106—, pp 185-202) **Long-term fertilization using sludge and the results of specific cultivation experiments.** Thorn, W. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE85770201.

From 16. Essen meeting on sewage sludge - raw material or pollutant; Essen, F.R. Germany (9 Mar 1983).

The digested sludge from the Bad Bramstedt treatment plant, which has an extremely low toxic content, has now been used for 12 years once or twice a year for the fertilization of arable and grazing land. Comparative investigations on soil samples show no indication of toxic concentrations. The digested sludge was thickened with dilute acid from Nordenham in an experimental plant and used for cultivation experiments on the experimental farm Wulfsdorf near Hamburg. The thickened sediment from the digested sludge is relatively low in potassium and rich in orthophosphates. Cabbage, potatoes and onions were cultivated. During the first few weeks plots with the conventional mineral fertilization showed faster growth. This status changed during the months July and August. The harvest with thickened digested sludge was higher than with mineral fertilizer. However, the thickened sludge has to be suitably dosaged. After increased dispersion all the signs of excessive fertilization could be observed. It is suggested that correctly used digested sludge fertilization be repeated every year. The employment of digested sludge for fertilization purposes has to depend on the toxic content. Polycyclic, aromatic organic compounds, branched alkanes, stable halogenised products are additionally concentrated during the retention time of the sludge in the digestion chamber if the influent values are high, as is the case in most metropolitan plants.

25778 (CONF-8303106—, pp 333-346) **Comparative evaluations of different extraction methods for sewage sludge during investigations of organic halogen compounds.** Alberti, J. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE85770201.

From 16. Essen meeting on sewage sludge - raw material or pollutant; Essen, F.R. Germany (9 Mar 1983).

Up to now sewage sludge has been primarily investigated from an inorganic viewpoint, particularly on its heavy metal content. The sewage sludge ordinance also deals with these substances. Furthermore, sewage sludge is also enriched in a large number of organic substances with a chronic-toxic effect, such as, organic halogenic compounds. However sample preparation for the analysis of these substances is rather problematic, since the various methods cannot always register all the substances present. Thus, damp sludge shows unsatisfactory results with the help of extraction media, whereas volatile substances in dried sludge cannot be measured quantitatively. The various methods of sample preparation and the results for volatile and stable organic halogenic compounds are discussed individually. The results show that a standardization of the sample preparation methods is imperative.

25779 (CONF-8303106—, pp 347-369) **Deposition of sewage sludge in domestic and mono-dumps - the effects on the decompostion process and on the composition of the leakage water.** Merkel, E.; Soddemann, W. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE85770201.

From 16. Essen meeting on sewage sludge - raw material or pollutant; Essen, F.R. Germany (9 Mar 1983).

Sewage sludge from waste water treatment plants for communal waste water is generally attributed to domestic sewage even if the sewage sludges have an industrial component. They belong to the waste category, which as a rule can be disposed together with domestic waste. The disposal of this waste should not have any effects other than those to be expected for residential waste. Systematic investigations are to be employed to ascertain the truth of this statement specially for long-term effect. Simultaneously the deposition of sewage sludge at mono-dumps must be considered. A detailed perception of the long-term behaviour and remobilisation effects of certain substances, e.g., heavy metals at this kind of dump is not available at present. In order to prepare for a corresponding research project, initial experiments with a bio-reactor are being carried out at the Regional Agency for Water and waste, NW. The initial aim is to test the suitability of various investigative methods to study the long-term behaviour of sewage sludge conditioned by different methods and deposited subsequently at a dump. The investigative methods applied and initial results are presented.

25780 (DOE/R8/01086—T1) **Making of a community energy management plan. Final technical report.** Robbins, C.; Desenberg, D. (Colorado Office of Energy Conservation, Denver (USA)). 3 Jun 1983. Contract FG48-81R801086. 27p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85011346.

CEM planning is a systematic approach to analyzing how a community uses energy, what types of energy the community uses and how much it costs. The process gathers historical data and projects future trends. This study took place in a politically conservative community with the municipally owned utility with almost the lowest rates in the state. The study area encompassed three counties, which included one large city and several rural communities. It didn't cost very much money. But hopefully, someone may read this and learn from our experience and make their CEM project a little smoother.

25781 (DOE/R8/01413—T1) **Neighborhood Network: a method for inducing and sustaining citizen participation in low technology recycling. Final progress report.** (Colorado Univ., Boulder (USA). Inst. of Behavioral Sciences). 1 Feb 1982. Contract FG48-80R801413. 31p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85011317.

Information presented in this report supports the conclusion that the Neighborhood Network has indeed successfully increased the level of recycling participation on Boulder's curbside pickup program through the recruitment of block leaders. Our data also suggest that the impact of block leader activity is relatively long-lasting - that is, the number of block leaders and percent participation continued to increase after we ended our recruitment and coordinating activity. The absolute number of block leaders and hence participation levels did not increase as much as anticipated.

25762 (STEV-TORV—83-11) Forest and peat fuels for Umeaa. Widen, M.; Joernlid, S.; Gidloef, S. (Statens Energiverk, Stockholm (Sweden)). Oct 1983. 82p. (In Swedish). NTIS (US Sales Only), PC A05/MF A01. File Number DE85750898.

The possibilities, organization and costs for supplying and burning domestic solid fuels (wood and peat) at a municipal cogeneration plant for Umeaa are investigated in this report. The planned district heating/power plant should produce 100 MW heat and 50 MW electric power. According to the plans, the plant should be taken in operation between 1988 and 1992. The investment cost estimates include 550 MSEK for the combustion plant and 75 MSEK for fuel production.

3209 Education And Public Relations

REFER ALSO TO CITATION(S) 25729

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

25783 (N—85-12318) Methane heat transfer investigation. Cook, R.T. (Rockwell International Corp., Canoga Park, CA (USA). Rocketdyne Div.). Nov 1984. 23p. (NASA-CR—171199). NTIS, PC A02/MF A01.

Future high chamber pressure LOX/hydrocarbon booster engines require copper-base alloy main combustion chamber coolant channels similar to the SSME to provide adequate cooling and resuable engine life. Therefore, it is of vital importance to evaluate the heat transfer characteristics and coking thresholds for LNG (94% methane) cooling, with a copper-base alloy material adjacent to the fuel coolant. High-pressure methane cooling and coking characteristics were recently evaluated using stainless-steel heated tubes at methane bulk temperatures and coolant wall temperatures typical of advanced engine operation except at lower heat fluxes as limited by the tube material. As expected, there was no coking observed. However, coking evaluations need be conducted with a copper-base surface exposed to the methane coolant at higher heat fluxes approaching those of future high chamber pressure engines.

3301 Internal Combustion Engines

REFER ALSO TO CITATION(S) 25229, 25684, 25790

25784 (NP—5770205) Reaction of the shape of the combustion space and charge movement on the course of combustion in petrol engines. Prescher, K. (Koeln Univ. (Germany, F.R.)). [1985]. 58p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE85770205.

During development work extending over several years, various shapes of combustion space were systematically examined, both for suction engines and for supercharging, with regard to low emission of noxious substances, low fuel consumption and octane number required (resistance to knocking). The 2 zone process model including a configuration of the combustion space function a speed of combustion function and taking dissociation into account describes the processes in petrol engines very well. The use of hot wire anemometers for the detailed analysis and description of the charge movement condition according to speed fields, intensity of turbulence and turbulence structure was refined for use in petrol engines. There are detailed reports on comparisons of different shapes of combustion space and charge movement conditions and ways of describing and analysing the course of combustion in petrol engines by models and details of the actual process model are given. The detection and analysis of the charge movement condition are also described. Results of experiments and model calculations are compared.

25785 (NP—5770206) Changing the course of mixture preparation and combustion in Diesel engines by increasing the pressure drop at the injection nozzle. Heinrich, G.; Prescher, K. (Hamburg Univ. (Germany, F.R.); Koeln Univ. (Germany, F.R.)). [1985]. 26p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE85770206.

In order to obtain information on the possible advantages and the operating mechanism of high pressure injection, thorough investigations were carried out on the course of mixture preparation and combustion, using high frequency films, according to the "Toepler streak" method. In parallel with this, there were investigations on a single cylinder engine in suction operation, in order to quantify the changes, which can be seen qualitatively from the combustion films, in the mixture preparation and combustion processes in their effects on the operating characteristics of the engine, compared with conventional injection. It was found that an increase in the fuel pressure drop at the injection nozzle of direct injection vehicle Diesel engines led to a reduction of the fuel jet and therefore to an increased speed of evaporation. Also, the total jet pulse occurring at the nozzle mouth grows, which favours the spreading of the fuel jet in the combustion space air and quicker mixing of fuel and air occurs. These mixture formation effects lead to quicker combustion, which has favourable effects on the internal efficiency and leads to a reduction of soot emission.

25786 (NP—5770210) Realisation of an axial piston motor with continuous internal combustion. Reimann, J. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Maschinenwesen). 3 May 1982. 179p. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE85770210.

The thesis deals with technical problems and special characteristics of motors with continuous internal combustion. Special attention is given to the type axial piston motor in order to describe the constructive demands and preconditions for the realisation of this motor. The development of the essential components until they were basically ready for use and the most important test results are described. The basic process control of motors with continuous internal combustion is described, the essential component groups are mentioned: axial bearings, sealing systems, fuel injection, influence of the charge cycle on the combustion process. Test results (measurements) of the 0,6 l- and 3.0 l engine are presented. This includes: thermal expansion, testing of the hydrostatic journal bearing, influence of a change of dead-centre position on the piston displacement.

25787 (NP—5770211) Investigation of a combustion chamber system with internal combustion gas recirculation for an axial piston motor with continuous internal combustion. Voigt, D. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Maschinenwesen). 3 May 1982. 224p. (In German). NTIS (US Sales Only), PC A10/MF A01. File Number DE85770211.

Studies are made for the development of a combustion chamber that is suitable for an axial piston engine. The combustion chamber must answer to the special demands of the specific properties of the axial piston motor especially with regard to flame stability during pulsating gas flow and -outflow and a broad operating range. These demands differ greatly from those of other drive aggregates with continuous combustion (gas turbine, Stirling-motor). Solutions for low-pollution combustion chambers found for the latter are therefore not suitable. After various preliminary tests with a number of different combustion chambers one decided to use combustion chamber type with internal combustion gas recirculation, known from process engineering, as a basis as its function, especially when it comes to pollutant emission of the exhaust gas - offers advantages compared to other types. This type of combustion chamber was adapted in the best possible way to the demands of an axial piston motor. Minimising of heat losses caused by external cooling was given special attention.

3303 Electric-powered Systems

25786 (DOE/CE—0123) Electric and Hybrid Vehicles Program. Eighth annual report to Congress for fiscal year 1984. (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC. Office of Vehicle and Engine Research and Development). Feb 1985. 31p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85010025.

In FY 1984, a new Electric Vehicle Test Center was established at the DOE Idaho National Engineering Laboratory (INEL). The dynamometer test facility that is utilized for in-vehicle evaluation of new battery and propulsion system technologies as well as recently developed proof-of-concept vehicle systems became operational in September 1984. The dynamometer facility was moved from the NASA/Jet Propulsion Laboratory that is phasing out of the EHV Program. The thrust of the Electric and Hybrid Vehicle Program in FY 1984 continued to be on battery and propulsion subsystems development up to the level of the testing and evaluation of proof-of-concept vehicles. The progress being made in developing electric and hybrid vehicle technologies is described beginning with highlights of recent accomplishments in FY 1984. Detailed descriptions of the program activities during FY 1984 are given on battery, powertrain and propulsion systems development and the testing and evaluation of new technology in fleet site operations and laboratory testing.

3304 Hybrid Systems

REFER ALSO TO CITATION(S) 25788

3307 Emission Control

25789 (NP—5770280) Emission control in passenger cars - a contribution to environmental protection. Berg, W. (Daimler-Benz A.G., Stuttgart (Germany, F.R.)). 1984. 54p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE85770280.

A survey on various methods of exhaust gas purification of passenger cars and on consequences of technical solutions. The international emission control laws are described, then details are given on emission control of passenger cars with Otto- and Diesel engines. Emission control of old cars requires refitting with suitable parts and measures such as CO-idle setting, NOsub(x)-emission control by checking and setting measures. A final summary deals with developments and tendencies in the FRG and Europe in general.

3308 Alternative Fuels

25790 (AD-A—149738/7/XAB) Diesel-fuel alternatives for engines in civil works prime movers. Interim report. Sliwinski, B.J.; Corcoran, E. (Army Construction Engineering Research Lab., Champaign, IL (USA)). Sep 1984. 70p. (CERL-IR-E—200). NTIS, PC A04/MF A01.

This is the first phase of research to determine fuel alternatives for Corps of Engineers medium-speed diesel engines. The literature has been searched to provide a background in current research and to identify the most promising alternatives to petroleum fuel. The criteria assessed were performance-based, with most variables compared to a No. 2 diesel fuel baseline. Results indicate that liquified coal, cetane-improved alcohol, and vegetable oils may be suitable alternatives. However, since much of the data reviewed were based on high-speed engines, additional data on medium-speed engines must be gathered making final recommendations.

25791 (PB—85-157485/XAB) Gas-oil/water emulsion fuel for automotive diesel engines. Final report. (Commission of the European Communities, Luxembourg). [1985]. 200p. (In Italian). (EUR—9074-EN-IT). NTIS, PC E08/MF E01.

The results achieved in the tests of high-speed diesel engines with water in oil emulsion feeding system are summarized. First, trials carried out on a test bench are described; then, operation in light-duty trucks on the road and on a roller-test bench is reported, and trials with constant-speed diesel engine are related. Finally, the work about emulsion characterization is synthetized. The conclusion shows that the water in oil emulsion is a feeding system suitable for high-speed diesel engine operation because BSFC, grade of smoke, exhaust temperature, and emission are lowered without considerable troubles.

36 MATERIALS

25792 (ORNL—6128) Solid State Division progress report for period ending September 30, 1984. Green, P.H.; Watson, D.M. (eds.). (Oak Ridge National Lab., TN (USA)). Mar 1985. Contract AC05-84OR21400. 294p. NTIS, PC A13/MF A01; GPO Dep. File Number DE85008766.

During the reporting period, relatively minor changes have occurred in the research areas of interest to the Division. Nearly all the research of the Division can be classified broadly as mission-oriented basic research. Topics covered include: theoretical solid state physics; surface and near-surface properties of solids; defects in solids; transport properties of solids; neutron scattering; and preparation and characterization of research materials. (GHT)

3601 Metals And Alloys

REFER ALSO TO CITATION(S) 25133, 25292, 25324, 25511, 25540, 25547, 25548, 25549, 25550, 25551, 25552, 25553, 25554, 25555, 25556, 25557, 25558, 25559, 25560, 25561, 25562, 25563, 25913, 25964, 25975, 26304, 26502

25793 (AD-A—150092/5/XAB) Evaluation of the use of sputter profiling with XPS or AES for the study of surface carburization resulting from high energy (>20 keV) ion implantation. Clayton, C.R. (State Univ. of New York, Stony Brook (USA)). 29 Oct 1983. 20p. NTIS, PC A02/MF A01.

Auger depth profiling was used previously with Xe ion etching to determine the extent of carburization resulting from ion implantation. In this report, the possibility of surface carburization resulting from the low-energy ion bombardment associated with sputter profiling was investigated. When a sample is analyzed by AES or XPS, a surface-contaminant layer of carbonaceous material is always observed. The source of the contamination may be external and/or vacuum-related. The following are likely sources: atmospheric, cleaning solvents, rotary pump oil during initial pump down, diffusion pump fluid (polyether), and out-gassing of anodes and filaments. The carbon contamination layer was examined as a source of carbide formation at the near surface region of the substrate of a high-purity Cr sample. The influence of the Xe ion acceleration potential, the amount of carbon contamination, and the thickness of the surface oxide layer on the amount of carbide formed was determined.

25794 (BNL—36286) Determination of edge and screw dislocation density in single crystals of high-purity iron. Park, Y.K.; Waber, J.T.; Snead, C.L. Jr. (Northwestern Univ., Evanston, IL (USA). Dept. of Materials Science and Engineering; Brookhaven National Lab., Upton, NY (USA)). 1985. Contract AC02-76CH00016. 4p. (CONF-850169—5). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010237.

From 7. international conference on positron annihilation; New Delhi, India (6 Jan 1985).

The trapping of positrons in dislocation-associated traps has been studied and the density of traps has been demonstrated to be in close agreement with the density of dislocations determined by TEM and etch-pit measurements on the same specimens. The specific trapping rates were determined.

25795 (BNL—36287) Reduction of the trapping of positrons in dislocated single crystals of iron when charged with hydrogen. Park, Y.K.; Waber, J.T.; Snead, C.L. Jr. (Northwestern Univ., Evanston, IL (USA). Dept. of Materials Science and Engineering; Brookhaven National Lab., Upton, NY (USA)). Jan 1985. Contract AC02-76CH00016. 4p. (CONF-850169—7). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010235.

From 7. international conference on positron annihilation; New Delhi, India (6 Jan 1985).

The positron annihilation measurement was carried out with the pure iron single crystals deformed in various ways before and after hydrogen permeation. The positron trapping intensity was reduced more in the screw dislocation than in the edge dislocation by hydrogen charging. The trap occupancy by hydrogen was very close to the fraction of the reduction in positron trapping intensity.

25796 **(BNL—36359) Neutron scattering study of the heavy fermion system UBe_{13}.** Shapiro, S.M.; Goldman, A.I.; Shirane, G.; Cox, D.E.; Fisk, Z.; Smith, J.L. (Brookhaven National Lab., Upton, NY (USA); Los Alamos National Lab., NM (USA)). 1985. Contract AC02-76CH00016. 9p. (CONF-8504115—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010955.

From 5. international conference on crystalline field effects in f-electron systems: ICCF5; Sendai, Japan (15 Apr 1985).

Neutron scattering measurements were performed on polycrystalline samples of UBe_{13} in order to establish more accurately the structure and probe the dynamics of the spin fluctuations. The structure was confirmed to be cubic with space group 0/sub h/ ^{6}(Fm3c) with BeII positional parameters y = .1763(1) and z = .1150(1). The inelastic spectrum at T = 10K exhibit a broad response with half width at half maximum of 15 MeV. 11 refs.

25797 **(CONF-830437—4) Substructure and microhardness correlation of polycrystalline copper plastically deformed in tension, compression and solid particle erosion modes.** Wey, Y.G.; Moteff, J.; Ives, L.K. (Cincinnati Univ., OH (USA). Dept. of Materials Science and Metallurgical Engineering; National Bureau of Standards, Washington, DC (USA)). 1983. Contract FG22-81PC40794. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010618.

From ASME international conference on wear of materials; Reston, VA, USA (11 Apr 1983).

Solid particle erosion data and the mechanics of the impact process have been reported for many materials. However, relatively little effort has been devoted to the evaluation of the erosion induced microstructural changes that occurred in the subsurface region. In particular, the erosion induced plastic deformation results in a strain hardening gradient that rapidly decreases with distance from the eroded surface. For the case of pure polycrystalline copper eroded at room temperature with alumina particles at four different conditions, the erosion damage gradient was determined indirectly by means of microhardness measurements and also through direct observations of the dislocation microstructure by transmission electron microscopy (TEM). Two particle velocities, 20 and 60 m/s, were considered at both 20 and 90 degree attack angles. The microhardness and TEM information obtained from the erosion specimens were then compared with similar data obtained from uniaxial tension and compression specimens tested to different true strain levels between the yield strength and the ultimate tensile strength. Both the tensile and the compressive shear flow stress levels (tau) were found to be related to the mean dislocation cell diameter (d) by the equation tau = $11.5Gbd^{-1}$ where G is the shear modulus and b the Burgers vector. 8 figs.

25798 **(CONF-850103—9) Load-carrying capabilities of refractory alloys for space reactor power applications.** Horak, J.A. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 47p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85010566.

From 2. symposium on space nuclear power systems; Albuquerque, NM, USA (14 Jan 1985).

To achieve sufficient thermodynamic efficiency, space nuclear power systems must operate above 1000°C. A quantitative evaluation of the existing mechanical properties data for the refractory alloys relevant to space nuclear power systems design lifetimes up to seven years at temperatures up to 1400°C is being conducted. The most important properties for space nuclear power systems are long-term high-temperature (>1000°C) creep strength and ductility, low-temperature (<400°C) fracture toughness [including ductile-to-brittle transition temperature, (DBTT)], and ductility at high strain rates; of special concern are the above properties for weldments of refractory alloys, composition, applied stress, test temperature, test environment (e.g., vacuum, lithium), and thermomechanical treatment (TMT) history. Currently being evaluated are, in order of ascending mp, selected alloys of niobium (e.g., Nb-1% Zr, Nb-1% Zr-0.1% C), molybdenum (e.g., Mo-13% Re), tantalum (e.g., ASTAR-811C), and tungsten (e.g., CVD W and W-25% Re). Creep properties of these alloys have been correlated via Larson-Miller, Manson-Hafered, and other empirical parameters; creep equations have been developed from these correlations. 12 figs., 8 tabs.

25799 **(CONF-850169—4) Positron annihilation Doppler broadening study of niobium.** Smedskjaer, L.C.; Loper, G.D.; Chason, M.K.; Gerber, S.B.; Siegel, R.W. (Argonne National Lab., IL (USA)). Jan 1985. Contract W-31-109-ENG-38. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010287.

From 7. international conference on positron annihilation; New Delhi, India (6 Jan 1985).

Doppler broadening of the positron annihilation lineshape has been measured for 99.995 wt % pure niobium in the temperature range 300 to 2581°K. It was found that the effect of the equilibrium vacancies upon the Doppler-broadened lineshape in pure niobium is much smaller than that normally found for other metals, in agreement with an earlier study. Furthermore, the addition of 100 at. ppM oxygen to the niobium produced no measurable effects on the lineshape, within the experimental uncertainties, either within or below the vacancy-sensitive temperature region. The results are discussed in relation to previous investigations of positron trapping at vacancies in niobium, as well as to studies of vacancy migration in metals.

25800 **(CONF-850169—9) PAS determination of the vacancy formation enthalpy in tungsten.** Smedskjaer, L.C.; Chason, M.K., Siegel, R.W. (Argonne National Lab., IL (USA)). Jan 1985. Contract W-31-109-ENG-38. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010283.

From 7. international conference on positron annihilation; New Delhi, India (6 Jan 1985).

A measurement of the vacancy formation enthalpy in 99.999 wt % pure tungsten under thermal equilibrium conditions was made using the positron anihilation spectroscopy (PAS) Doppler-broadening technique. Temperatures were measured by optical pyrometry, with calibrations against a W(Re) thermocouple, the tantalum melting point, and the power delivered to the sample. A trapping-model analysis of the PAS data from the temperature range 300 to 3633 K yielded a vacancy formation enthalpy of 3.76 +- 0.39 eV. Comparisons are made between the present result and the other available results on vacancy formation in tungsten.

25801 (CONF-8403124—Pt.1, pp 183-193) **Local density studies on transition-metal clusters, surfaces, and the oxide defect state.** Ellis, D.E. (Northwestern Univ., Evanston, IL). 1984. NTIS, PC A99/MF A01. File Number DE85009401. Contract AC02-83ER45043.

From Sanibel symposia; Palm Coast, FL, USA (1 Mar 1984).

Aspects of recent local density (LD) studies on transition-metal clusters, surface complexes, and oxide defect structures are presented. The evolution of the LD theory as a reliable means of predicting spectroscopic and structural properties of transition-metal systems is explored. As specific examples we consider the magnetic impurity problem, the chemisorption of simple molecules, and the effect of oxide vacancies on x-ray absorption cross sections.

25802 **(CONF-8506111—1) Effects of high mean stress on the high-cycle fatigue behavior of PWA 1480.** Majumdar, S.; Antolovich, S.; Milligan, W. (Argonne National Lab., IL (USA); Georgia Inst. of Tech., Atlanta (USA)). Mar 1985. Contract W-31-109-ENG-38. 14p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010509.

From Conference on structural integrity and durability of reusable space propulsion systems; Cleveland, OH, USA (4 Jun 1985).

PWA 1480 is a potential candidate material for use in the high-pressure fuel turbine blade of the Space Shuttle Main Engine. As an engine material it will be subjected to high-cycle fatigue loading superimposed on a high mean stress due to combined centrifugal and thermal loadings. This paper describes results obtained

in an ongoing program to determine the effects of a high mean stress on the high-cycle fatigue behavior of this material.

25803 (DOE/ER/10428—05) Protective oxide films. [Final report], 1 April-30 November 1983. MacCrone, R.K. (Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Materials Engineering). 1983. Contract AC02-79ER10428. 25p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85007345.

In both the case of nickel and titanium metal oxidation studies, research has shown a large number of fundamental differences between present understanding of oxidation and our observations. In addition, totally new observations have been made: the observation that there is considerable transport of oxygen towards the metal-oxide interface, despite suggestions made by Hughes (Ref. 6) that Ni diffuses through grain boundaries towards the gas interface; the surface state of the metal plays some vital role in the process of metal inclusion in the case of nickel; grain boundaries are important; oxidation of Ti appears controlled by Ti interstitials when the metal is pure; oxide scales from impure Ti metal incorporate many of the impurities of the base material; and impurities in the Ti, particularly Mo, suppress the interstitial content of the oxide, and must therefore alter the growth mechanism.

25804 (DOE/NASA—0006-2) Determination of hydrogen permeability in commercial and modified superalloys. Bhattacharyya, S.; Peterman, W. (IIT Research Inst., Chicago, IL (USA)). May 1983. Contract AI01-77CS51040. 98p. (NASA-CR—168195). NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85009910.

This report summarizes the results of hydrogen permeability measurements on several iron- and cobalt-base alloys as well as on two long-range ordered alloys over the range of 705° to 870°C (1300° to 1600°F). The test alloys included wrought alloys N-155, IN 800, A-286, 19-9DL, and 19-9DL modifications with aluminum, niobium, and misch metal. In addition, XF-818, CRM-6D, SA-F11, and HS-31 were evaluated. Two wrought long-range ordered alloys, Ni_3Al and $(Fe,Ni)_3(V,Al)$ were also evaluated. All tests were conducted at 20.7 MPa pressure in either pure and/or 1% CO_2-doped H_2 for test periods as long as 133 h. Detailed analyses were conducted to determine the relative permeability rankings of these alloys and the effect of doping, exit surface oxidation, specimen design variations, and test duration on permeability coefficient, and permeation activation energies were determined. The two long-range ordered alloys had the lowest permeability coefficients in pure H_2 when compared with the eight commercial alloys and their modifications. With CO_2 doping, significant decrease in permeability was observed in the commercial alloys - no doped tests were conducted with the long-range ordered alloys.

25805 (DOE/NE/37900—6) Effects of heat treatment and tracer element impurities on the impact properties of the 12Cr steels. Chin, B.A.; Wilcox, R.C.; Rou, S.H.; Harrelson, K.J. (Auburn Univ., AL (USA). Dept. of Mechanical Engineering). 15 Sep 1984. Contract AS05-82NE37900. 105p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85010676.

The addition of sulfur up to 0.05% embrittles HT-9 steels by decreasing the upper shelf energy. Sulfur has little or no effect on the DBTT. The addition of up to 0.05% phosphorous decreases the upper shelf energy but has no effect on the DBTT. The addition of copper up to 0.15% decreases the upper shelf energy but has no effect on the DBTT. Effects of heat treatment on microstructure and ductile-brittle transition temperature of HT-9 were also investigated.

25806 (DP-MS—84-81) Solid-state resistance welding cylinders and spheres. Kanne, W.R. Jr. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 1985. Contract AC09-76SR00001. 22p. (CONF-8504102—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010064.

From 66. AWS annual meeting; Las Vegas, NV, USA (28 Apr 1985).

It is the goal of the work presented here to develop an upset welding process for fabrication of small vessels and to demonstrate the advantages of the process. Major emphasis has been directed toward welding 304L stainless steel, although the weldability of other steels has received limited study.

25807 (EPRI-NP—3949M) Surface and grain boundary segregation, stress corrosion cracking, and corrosion fatigue of Inconel 600. Smialowska, S.; Cragnolino, G.; Macdonald, D.D. (Ohio State Univ., Columbus (USA). Dept. of Metallurgical Engineering). Mar 1985. 37p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920590.

The stress corrosion cracking of Inconel 600 in environments related to nuclear power systems was studied in relation to the role of segregation in the alloy. Auger electron spectroscopy was used to evaluate the surface segregation of different impurities in Inconel 600 as a function of heat-to-heat variation and heat treatment. The degree of segregation of various elements (S, P, N, Ti, Si, and C) on the fracture surface of nickel was also evaluated as a function of the heat treatment employed, temperature, and cooling rate. The effects of alloying elements, added to nickel with the aim of reducing sulfur segregation to grain boundaries, was also studied. The susceptibility of nickel to intergranular corrosion in acidic and alkaline solutions at different potentials was measured as a function of sulfur segregation to the grain boundaries. The effect of heat treatment and applied potential on the caustic stress corrosion cracking susceptibiliy of Inconel 600 was studied in concentrated NaOH solutions at 140°C using the slow strain rate technique. The corrosion fatigue resistance of Inconel Alloy 600 in concentrated NaOH solutions at 140°C was evaluated as a function of heat treatment conditions using smooth bar specimens. The results have shown that the stress corrosion behavior of Inconel 600 in caustic solutions differs greatly from that in acidic and nearly neutral environments. Furthermore, sensitization by heat treatment was found to be beneficial under caustic corrosion conditions but detrimental in acidic environments.

25808 (EPRI-NP—3957M) Mechanism of intergranular corrosion of Inconel 600 tubing in PWR steam generators. Final report. Miglin, B.P.; Sarver, L.W. (Babcock and Wilcox Co., Alliance, OH (USA). Research and Development Div.). Mar 1985. 43p. Research Reports Center, Box 50490, Palo Alto, CA 94303 $8.50. File Number TI85920561.

Laboratory tests show that intergranular corrosion of PWR steam generator tubing can be produced by caustic alone if the temperature of the tubing is high enough. The exposure time required for this type of corrosion to appear decreases as the temperature increases.

25809 (HEDL-SA—3155FP) Fatigue-crack propagation behavior of alloy A-286. James, L.A. (Hanford Engineering Development Lab., Richland, WA (USA)). 1985. Contract AC06-76FF02170. 21p. (CONF-850670—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85007460.

From ASME pressure vessel and piping division conference; New Orleans, LA, USA (24 Jun 1985).

The effect of temperature upon the fatigue-crack propagation behavior of Alloy A-286 was studied at temperatures of 24, 316, 427, and 538°C. Two different heats representing two different product forms (strip and round bar) were employed. The effect of crack orientation was investigated for both product forms: T-L and L-T orientations in the strip and R-C and R-L orientations in the round bar. Specimens were irradiated to total neutron fluences of 7.5×10^{21} n/cm^2 and 5.2×10^{22} n/cm^2, and the effect of irradiation to these levels upon crack growth behavior was studied at 427°C.

25810 (IC—84/61) Surface states in In-ZnTe structures. Tupenevich, P.A.; Buzaneva, E.V.; Kononenko, V.K. (International Centre for Theoretical Physics, Trieste (Italy)). Jun 1984. 6p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700589.

An effect of the surface states on the In-ZnTe structure capacitance is discussed. For the first time the surface state energy spectrum in ZnTe structures is reported.

25811 (IC—84/81) Electrical resistivity of amorphous Fesub(1-x) Bsub(x) alloys. Paja, A.; Stobiecki, T. (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1984. 6p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700590.

The concentration dependence of the electrical resistivity of amorphous Fesub(1-x) Bsub(x) alloys has been studied over a broad composition range. The measurements for RF sputtered films made in the liquid helium temperature have been analyzed in the framework of the diffraction model. The calculated results are in good agreement with the experimental data in the range of concentration $0.12 < x < 0.37$ where samples are amorphous and have a metallic character.

25812 (KHM-TR—102) Comparison of the influence of emissions on atmospheric corrosion at heating with coal and oil respectively. Dahl, L.; Kucera, V. (Statens Vattenfallsverk, Vaellingby (Sweden). Projekt KOL-HAELSA-MILJOE). May 1983. 60p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. File Number DE85750878.

At the request of the project KOL-HAELSA-MILJOE a literature study has been made to look for qualitative and quantitative effects from coal firing on the atmospheric corrosion of construction materials compared with the effects from oil-firing. Moreover, the corrosion of steel and zinc have been calculated from future energy scenarios including coal firing for one small town and a bigger one. There are several relationships between the corrosion rate of steel and zinc and the sulphur dioxide concentration in the air, which makes it possible to calculate the corrosion rates for different alternatives of emission. The increase of the SO_2-concentration will not only give a strongly increased corrosion on construction materials but also historical monuments and buildings of sand- and limestone will corrode at a higher corrosion rate. Corresponding relationships are not found in the literature for NO(sub)x, hydrogen chloride or fly-ash. NO(sub)x has no pronounced effect on outdoor corrosion of steel and zinc. Indoor electrical contact materials can be affected. Hydrogen chlorides has a strong influence on many materials, while the fly-ashes due to their varying character, mostly alkaline or neutral are judged to have a limited effect on the atmospheric corrosion. Performed model corrosion calculations are based on SO_2 -concentrations from the scenarios defined by the KOL-HAELSA-MILJOE-project: These calculations demonstrate a reduction of the corrosion between 10 and 30 %, under given assumptions, i.e. transition to a certain share of coal in the energy system, use of high chimneys and at last, introduction of district heating in the towns considered. The effect of other compounds than sulphur dioxide will probably not change the overall picture and thus in all cases there will probably not be an increase of the corrosion.(author).

25813 (LA-UR—85-1471) Plutonium metal preparation and purification at Los Alamos, 1984. Christensen, D.C.; Williams, J.D.; McNeese, J.A.; Fife, K.W. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 30p. (CONF-841235—1). NTIS, PC A03/MF A01; GPO Dep. File Number DE85010732.

From International symposium on lanthanide-actinide separations; Honolulu, HI, USA (16 Dec 1984).

Plutonium metal preparation and purification are well established at Los Alamos. Metal is prepared by calcothermic reduction of both PuF_4 and PuO_2. Metal is purified by halide slagging, casting, and electrorefining. The product from the production sequence is ultrapure plutonium metal. All of the processes involve high temperature operation and all but casting involve molten salt media. Development efforts are fourfold: (1) recover plutonium values from residues; (2) reduce residue generation through process improvements and changes; (3) recycle of reagents, and (4) optimize and integrate all processes into a close-loop system. Plutonium residues are comprised of oxides, chlorides, colloidal metal suspensions, and impure metal heels. Pyrochemical recovery techniques are under development to address each residue. In addition, we are looking back at each residue generation step and are making process changes to reduce plutonium content in each residue. Reagent salt is the principle media used in pyrochemical processing. The regeneration and recycle of these reagents will both reduce our waste handling and operating expense. The fourth area, process optimization, involves both existing processes and new process developments. A status of efforts in all four of these areas will be summarized.

25814 (LBL—17632) Microstructure-abrasive wear characteristics of low carbon dual phase steels. Kwok, C.K.; Thomas, G. (Lawrence Berkeley Lab., CA (USA)). Nov 1984. Contract AC03-76SF00098. 23p. (CONF-850415—4). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010988.

From 4. international conference on wear of materials; Vancouver, Canada (14 Apr 1985).

Intense plastic defomation due to abrasion is concentrated within a thin surface layer. There are, consequently, extensive microstructural changes from the worn surface to the interior. Microstructural examination of the surface morphology, and the transverse and longitudinal subsurface areas is necessary to elucidate the relationship between microstructures of the steels and the mode and magnitude of the plastic deformation. Some fundamental entities such as dislocation density, cell size and depth of deformation can be measured or estimated. High voltage transmission electron microscopy has been particularly useful in investigating the wear debris particles. A comprehensive mechanism of abrasive wear has been deduced based on these microstructural observations.

25815 (PB—85-134203/XAB) Nippon Kokan technical report, No. 103, July 1984. (Nippon Kokan K.K., Tokyo). [1985]. 137p. (In Japanese). NTIS, PC E05/MF E01.

See also PB85-134211, PB85-134229, and PB85-105070.

The issue contains articles on: Rolling Technics of Wide Flange Beams from Continuously Casted Materials; Research and Development of Hot Water Transportation by Thermosiphon; Studies on Environmental Impact Assessment; Study on Dynamic Behavior of Coal Silos against Earthquakes; Control Systems on Earthquake Resistance of Steel Structures; Fuel Saving Attained by a Navigation under Economical Ship Speeds; An Engineering Approach to Regional Development; Evaluation of Elasto-Plastic Behavior of Soft Welded Joints for High Strength Steel Pipes; Development of Radiation Thermometry Using Multiple Reflection as well as information on new achievements and Patents.

25816 (SAND—84-2058C) Specimen thickness effects for elastic-plastic CTOD toughness of A36 steel. Wellman, G.W.; Sorem, W.A.; Dodds, R.H. Jr.; Rolfe, S.T. (Sandia National Labs., Albuquerque, NM (USA); Kansas Univ., Kansas City (USA)). 1985. Contract AC04-76DP00789. 50p. (CONF-850679—1). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85006992.

From 18. American Society for Testing and Materials symposium; Boulder, CO, USA (1 Jun 1985).

This paper describes the results of an experimental and analytical study of the effect of specimen size on the fracture-toughness behavior of A36 steel, primarily in the lower-transition region. This region is beyond the limits of plane-strain as defined by ASTM E-399, but in the region where failure occurs prior to any macroscopic fibrous tearing. Experimental results were obtained using Crack-Tip Opening Displacement (CTOD) three-point bend specimens and analytical results were obtained using a 3-D elastic-plastic finite-element analysis. Two specimen sizes, full thickness (31.8 mm (1.25") thick) and reduced thickness (12.7 mm (0.50") thick), were investigated using the preferred t x 2t x 8t specimen size.

25817 (SAND—85-0949C) Amorphous alloys of ion-implanted Fe-Ti-C. Follstaedt, D.M.; Knapp, J.A. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 12p. (CONF-8504116—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010656.

From Workshop on ion mixing and surface alloying II; Pasadena, CA, USA (19 Apr 1985).

The implantation of Ti and C into Fe has previously been shown to produce a ternary amorphous phase which requires both Ti and C for its stabilization at concentrations $\lesssim$ 20 at. % Ti or C. More recently, depth profiling of Ti and C in Fe has been combined with ion channeling and TEM to deduce concentration boundaries of the amorphous phase. Here we discuss the boundaries

in terms of nucleation and stability of phases in the ternary Fe-Ti-C diagram.

25818 **(UCID—20386) Machining of beryllium with the LLNL Precision Engineering Research Lathe.** Foley, R.J. (Lawrence Livermore National Lab., CA (USA)). 1 Apr 1985. Contract W-7405-ENG-48. 24p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010832.

In August 1984, six flat samples of beryllium, which were prepared by Brush-Wellmen Corp. using various pressing and sintering processes, were machined at LLNL on the recently completed Precision Engineering Research Lathe (PERL). The purpose of this study, which was conducted in cooperation with the Hughes Aircraft Corporation and partially funded by that organization, was to determine the optical properties of machined beryllium surfaces when prepared under highly controlled conditions using high quality machine tools and CBN (cubic boron nitrite) cutting tools. This report will summarize the materials properties, the machining conditions used on the PERL and a comparison of the completed samples using optical measuring techniques and scanning electron microscopy (SEM). The mirror surface reflecting measurements in the IR region are to be made by the group at Hughes Aircraft and will be exchanged with LLNL as a part of this joint technical effort. 3 refs., 14 figs.

25819 **Lattice dynamics of the metastable fcc phase of lanthanum.** Stassis, C.; Smith, G.S.; Harmon, B.N.; Ho, K.; Chen, Y. (Ames LaboratoryU.S. Department of Energy and Department of Physics, Iowa State University, Ames, Iowa 50011). *Physical Review* [*Section*] *B: Condensed Matter;* **31**: No. 10, 6298-6304(15 May 1985).

A single crystal of the metastable fcc phase of La was grown of sufficient volume for the study of the lattice dynamics of this phase by coherent inelastic-neutron-scattering techniques. The phonon dispersion curves have been measured along the [ξ00], [ξξ0], [ξξξ], and [0ξ1] symmetry directions at room temperature and at 10 K. The room-temperature dispersion curves are almost identical to those of γ-Ce. In particular, the T[ξξξ] exhibits anomalous dispersion for $\xi >$ or ≈ 0.25. The temperature dependence of all but the T[ξξξ] branch is normal. The T[ξξξ] branch, on the other hand, develops at low temperatures a pronounced dip at a reduced wave vector of approximately 0.42. First-principles band-structure calculations, in which the 4f states were excluded, yield a Fermi surface with a nesting feature along the [ξξξ] direction and a corresponding peak in the bare susceptibility at the wave vector of the observed phonon anomaly. The room-temperature data were used to evaluate the elastic constants, the phonon density of states, and the lattice specific heat.

25820 **Investigation of the near-surface electronic structure of Cr(001).** Klebanoff, L.E.; Robey, S.W.; Liu, G.; Shirley, D.A. (Materials and Molecular Research Division, Lawrence Berkeley Laboratory and Departments of Chemistry and Physics, University of California, Berkeley, California 94720). *Physical Review* [*Section*] *B: Condensed Matter;* **31**: No. 10, 6379-6394(15 May 1985).

An angle-resolved photoelectron spectroscopy (ARPES) study of Cr(001) near-surface electronic structure is presented. Measurements are reported for energy-band dispersions along the [010] direction parallel to the crystal surface. The periodicity of these band dispersions indicates that the valence electrons experience and self-consistently establish antiferromagnetism in the near-surface layers of Cr(001). We also present highly-surface-sensitive ARPES measurements of the energy-band dispersions along the [001] direction normal to the surface. The results suggest that the surface magnetic moments, which couple ferromagnetically to each other within the surface layer, couple antiferromagnetically to the moments of the atoms in the second layer. Temperature-dependent studies are presented that reveal the persistence of near-surface antiferromagnetic order for temperatures up to 2.5 times the bulk Neel temperature. The temperature dependence of this antiferromagnetic order suggests that its thermal stability derives in part from the stability of the Cr(001) ferromagnetic surface phase.

25821 **Calculations for the transverse N-point phonons in bcc Zr, Nb, and Mo.** Chen, Y.; Fu, C.; Ho, K.; Harmon, B.N. (Ames Laboratory U.S. Department of Energy, and Department of Physics, Iowa State University, Ames, Iowa 50011). *Physical Review* [*Section*] *B: Condensed Matter;* **31**: No. 10, 6775-6778(15 May 1985). Contract W-7405-ENG-82.

The frequencies of the transverse N-point phonons in Nb and Mo have been calculated using the first-principles frozen-phonon method. The ordering of the modes is reversed in these metals in agreement with experiment. Similar calculations for the L and T_2N-point phonons in the high-temperature bcc phase of Zr agree with recent measurements, while the results for the T_1 phonon of Zr indicate an instability toward the formation of the hcp phase.

25822 **Enhanced hydrogen solubility in niobium films.** Moehlecke, S.; Majkrzak, C.F.; Strongin, M. (Brookhaven National Laboratory, Upton, New York 11973). *Physical Review* [*Section*] *B: Condensed Matter;* **31**: No. 10, 6804-6806(15 May 1985).

The solubility of hydrogen in niobium films (100—3000 A) and multilayers of Nb and Pd (20—130 A) has been studied as a function of film thickness by resistivity and x-ray measurements. The H concentration in solid solution was observed to be greatly enhanced, by a factor of more than 40, as the Nb films were made thinner. This suggests a dependence of the phase diagram on film thickness, with a depression of the Nb-H critical temperature for films thinner than 1200 A, but approaching the bulk values for thick films ($t > 2200$ A). Similar results were observed in Nb-Pd multilayers.

25823 **Solitons of the square-rectangular martensitic transformation.** Jacobs, A.E. (Department of Physics, Building 510A, Brookhaven National Laboratory, Upton, New York 11973 and Department of Physics and Scarborough College, University of Toronto, Toronto, Ontario, Canada M5S 1A7). *Physical Review* [*Section*] *B: Condensed Matter;* **31**: No. 9, 5984-5989(1 May 1985). Contract AC02-76CH00016.

The static solitons of the square-rectangular martensitic transformation are obtained with the use of higher-order elasticity theory; both first-order (rectangular-rectangular and square-rectangular solitons) and second-order (rectangular-rectangular only) phase transitions are treated. The shear and dilatational strains vanish in all cases. The deviatoric strains are calculated exactly, and the displacement vectors are obtained as power series, using the full (nonlinear) Lagrangian strain tensor. In the first-order case, the width of the rectangular-rectangular soliton diverges as the transition temperature is approached from below; the soliton splits gradually into two square-rectangular solitons, both of finite width, whose separation diverges at the transition temperature.

25824 **Spin and orbital magnetic densities in ferromagnetic nickel.** Felcher, G.P.; Maglic, R.; Cable, J.W.; Cooke, J.F. (Materials Science and Technology Division, Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review* [*Section*] *B: Condensed Matter;* **31**: No. 9, 5854-5857(1 May 1985). Contract AC05-84OR21400.

A polarized-neutron-diffraction experiment is described, aimed at detecting the asphericity of the orbital magnetic density of nickel. The results indicate that the orbital magnetic density is much more spherical than predicted by the atomic model. The experimental finding is fully consistent with that calculated on the basis of the itinerant-electron theory, in which the spin-orbit interaction has been taken into account.

25825 **Effect of high magnetic fields on the heat capacity of single-crystal terbium.** Ikeda, K.; Gschneidner K.A. Jr.; Takeshita, T.; Jones, D.W.; Farrant, S.P. (Ames Laboratory and Department of Materials Science and Engineering, Iowa State University, Ames, Iowa 50011). *Physical Review* [*Section*] *B: Condensed Matter;* **31**: No. 9, 5878-5883(1 May 1985).

The low-temperature (1.3 to 20.0 K) heat capacity of an electrotransport-purified terbium single crystal was measured in

magnetic fields up to 10 T applied along the magnetically hard basal-plane direction, i.e., <1120> or a axis. The electronic specific-heat constant, $\gamma = 3.71 +- 0.09$ mJ/g-at. K^2, and the Debye temperature at 0 K, Θ/sub D/ = 169.6 +- 0.8 K, were obtained from an analysis of the zero-field data. The heat capacity is almost independent of the magnetic field below 12 K, but above 12 K systematically increases as a function of increasing field up to ~3 T and then it remains almost unchanged. This indicates that the spin-wave energy gap due to the magnetic anisotropy in terbium increases with increasing fields at the rate of about 4 and 0.3 K/T below and above ~3 T, respectively.

25826 Physical realization of two-dimensional Ising critical phenomena: Oxygen chemisorbed on the W(112) surface. Wang, G.; Lu, T. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Physical Review [Section] B: Condensed Matter;* **31**: No. 9, 5918-5922(1 May 1985).

The continuous reversible order-disorder phase transition of oxygen chemisorbed on the W(112) surface at half-monolayer coverage was studied by low-energy electron diffraction (LEED). The critical phenomena associated with this phase transition are shown to belong to the two-dimensional Ising universality class. An attempt has been made to extract the critical exponents, and the limitations of the LEED system presently used are discussed.

25827 Direct metal brazing to cermet feedthroughs. Hopper, A.C. Jr. (to Dept. of Energy). US Patent 4,488,673. 18 Dec 1984. Filed date 29 Jul 1982. vp.

PAT-APPL-403219.

An improved method for brazing metallic components to a cermet surface in an alumina substrate eliminates the prior art metallized layer over the cermet via and adjoining alumina surfaces. Instead, a nickel layer is applied over the cermet surface only and metallic components are brazed directly to this nickel coated cermet surface. As a result, heretofore unachievable tensile strength joints are produced. In addition, cermet vias with their brazed metal components can be spaced more closely in the alumina substrate because of the elimination of the prior art metallized alumina surfaces.

25828 (BG-Trans—6419) Delayed cracking strength of experimental grades of 42 CD 4 steel in aqueous H_2S surroundings. Charbonnier, J.C.; Margot-Marette, H.; Aucouturier, M.; Brass, A.M. Translated from *Memoires et Etudes Scientifiques [de la] Revue de Metallurgie ;* **81**: No. 5, 225-238(May 1984). 30p. NTIS (US Sales Only), PC A03. File Number DE85901163. DE85901163

With a view to the development of new qualities of low alloy steels for drilling which have high mechanical characteristics (Rm 1000 MPa) and are resistant to stress corrosion in the presence of H_2S (sulphide stress cracking), we studied the behaviour of experimental qualities of 42 CD 4 steels of martensitic structure annealed at high temperature. The chemical composition of the qualities were modified by increasing the molybdenum content and adding, vanadium and titanium. The effect of these elements on their own and the combined effect of certain of them was examined both from the aspect of mechanical characteristics and delayed cracking behaviour in H_2S surroundings (sulphide stress cracking in NACE surroundings of pH3). Additions of molybdenum, vanadium, vanadium and titanium, molybdenum-vanadium-titanium enabled the objective to be attained. The maximum delay in softening was observed with the quality having an increased molybdenum content and the addition of vanadium and titanium. Amongst the addition elements studied, improvement in sulphide stress cracking behaviour is in the following order: 42 CD 4 + V, 42 CD 4 + Mo, 42 CD 4 + V + Ti, 42 CD 4 + Mo + V + Ti. The most spectacular effect is therefore obtained by increasing the molybdenum content and adding vanadium and titanium; for strength levels of 935 and 990 Mpa, the ultimate cracking threshold is then 500 MPa. The very satisfactory behavior of this quality enriched with Mo + Ti + V is explained by the beneficial role of deep trapping on the fine carbides which are very well distributed in the microstructure, and the creation of a considerable reserve of deep traps which, under mechanical stressing in aggressive surroundings, will play a delaying role for hydrogen and will possibly inhibit embrittlement. 26 refs., 13 figs., 5 tabs.

25829 Prediction of microstructural modification in dynamically consolidated metal powders. Gourdin, W.H. (Lawrence Livermore National Lab., CA). pp 379-382 of Shock waves in condensed matter - 1983. Asay, J.R.; Graham, R.A.; Straub, G.K. (eds.). New York, NY; Elsevier Science Publishers B.V. (1984). Contract W-7405-ENG-48.

A model is presented which describes the deposition of energy at the surface of powder particles during shock-wave consolidation. Solution of the thermal transport equation subject to boundary conditions of constant surface flux yields thermal histories which can be used to predict the type and extent of microstructural modifications following compaction. The application of the model to compacts of several different metal powders is discussed.

25830 Theory of the iron equation of state and melting curve to very high pressure. Young, D.A.; Grover, R. (Lawrence Livermore National Lab., CA). pp 65-68 of Shock waves in condensed matter - 1983. Asay, J.R.; Graham, R.A.; Straub, G.K. (eds.). New York, NY; Elsevier Science Publishers B.V. (1984). Contract W-7405-ENG-48.

A semiempirical equation of state for iron has been constructed by dividing the total energy into mean field, interatomic pair potential, and electronic thermal terms. The five adjustable parameters are fitted to the experimental isotherm, Hugoniot, and melting curve. Superimposing the estimated pressure and temperature conditions of the presumably pure solid iron inner core of the earth onto the calculated phase diagram shows an unexpected discrepancy.

25831 Hugoniot measurements in vanadium using the LLNL two-stage light-gas gun. Gathers, G.R.; Mitchell, A.C.; Holmes, N.C. (Lawrence Livermore National Lab., CA). pp 89-90 of Shock waves in condensed matter - 1983. Asay, J.R.; Graham, R.A.; Staub, G.K. (eds.). New York, NY; Elsevier Science Publishers B.V. (1984). Contract W-7405-ENG-48.

Hugoniot measurements on vanadium have been made using the LLNL two-stage light-gas gun. The direct collision method with electrical pins and a tantalum flyer accelerated to 6.28 km/s was used. Alt'shuler, et al, have reported Hugoniot measurements in vanadium using explosives and the impedance match method. They reported a kink in the U/sub s/ - U/sub p/ relationship at 183 GPa, and attribute it to electronic transitions. The upper portion of their curve is based on a single point at 339 GPa. The present work was performed to further investigate the equation-of-state in the high pressure range.

25832 Hugoniot measurements on unsintered metal powders. Gourdin, W.H.; Weinland, S.L. (Lawrence Livermore National Lab., CA). pp 99-102 of Shock waves in condensed matter - 1983. Asay, J.R.; Graham, R.A.; Straub, G.K. (eds.). New York, NY; Elseiver Science Publishers B.V. (1984). Contract W-7405-ENG-48.

The authors have determined the Hugoniots of unsintered copper, aluminum alloy, and steel powders using carbon gauges. They find no evidence for an elastic precursor in their specimens. The copper and aluminum Hugoniots are well described by models which assume full densification. Complete densification of the steel powder, however, does not occur for stresses less than 3.0 GPa. Although carbon gauges perform well, systematic errors in gauge calibration are observed.

25833 (CE-Trans—8063) Explanation of a ferrite to austenite structural memory phenomenon. Forchelet, J.; Form, W. Translated from *Memoires et Etudes Scientifiques [de la] Revue de Metallurgie ;* 525-538(Oct 1982). 31p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85901234. DE85901234

The photoemission electron microscope (PEEM) can be used to observe an effect of structural memory of ferrite for austenite during thermal cycling. Earlier research suggested that this phenomenon was neither a surface feature nor an accident of image-formation in the PEEM, but could be implanted within the body of a sample. Yet the mechanism of structural memory remained a mystery. The present study offers a coherent and unambiguous explana-

tion of the phenomenon in question. We have shown that retention of the memory effect is linked to the presence of untransformed metastable austenite, and the free sublimation of manganese at the surface of heat-treated specimens observed in the PEEM plays an essential role in explaining this phenomenon.

3602 Ceramics, Cermets, And Refractories

REFER ALSO TO CITATION(S) 25793, 25827, 25913

25834 **(AD—460596/0/XAB) High-temperature alkali-metal-resistant insulation. Final report.** Snavely, W.H. (Westinghouse Electric Corp., Lima, OH (USA). Aerospace Electrical Div.). Mar 1965. 227p. NTIS, PC A11/MF A01.

The experimental work was done to determine the effects of a combined environment on electrical conductors, ceramic insulators, potting compounds, and magnetic materials. The test environment combined 600 C saturated potassium vapor and electrical and fluctuating magnetic fields. The test devices were transformers fabricated from materials that had resistance to the corrosive action of saturated K vapor at elevated temperatures. Materials were exposed to 600 C and 850 C saturated K. Corrosion data were obtained. Materials to fabricate test transformers were selected by evaluating the K corrosion information. Two types of electrical terminal seals resistant to 600 C K vapor were developed. The electrical properties of these terminal seals in saturated K vapor at 600 C were determined. The seals were used to fabricate suitable K vapor test capsules for the test transformers. Transformers were fabricated and electrically tested in 300 and 600 C saturated K vapor. The test data obtained at a given elevated temperature in vacuum or Ar were compared with identical temperature points in saturated K vapor.

25835 **(AD-A—149756/9/XAB) Evaluation of corrosion/erosion behavior of various ceramic materials. Final report, 1 September 1980-30 June 1983.** Adams, J.W.; Larsen, D.C. (IIT Research Inst., Chicago, IL (USA)). Jun 1984. 347p. NTIS, PC A15/MF A01.

Baseline and simulated environment post-exposure test results of fourteen candidate ceramic materials for stationary power-generating gas turbines are presented. The materials studied were various material types of silicon nitride, silicon carbide, aluminum nitride, Al_2O_3-ZrO_2, Al_2O_3-SiC, $MgAl_2O_4$ spinel, and SiA1ON. One dynamic (1425°C, 305 m/s, 1000 hr) and nine static (1000, 1200, and 1425°C for 100, 300, and 1000 hr) exposures were conducted at the Morgantown Energy Technology Center facility of the Department of Energy. The exposure environment was coal-derived fuel gas combustion products created in a fixed-bed gasification system. Post-exposure evaluation involved evaluation of surface chemistry and morphology, weight and dimension change, retained room-temperature strength and fracture surface analysis. Based upon limited testing and the small sample population available, the materials are ranked according to their probable survivability in power turbine applications.

25836 **(BMFT-FB-T—85-015) Development of high-temperature resistant, noncorrodible, nonmetallic ceramic materials, especially silicon nitride in gas turbine application.** Blecha, M.; Pohlmann, H.J. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Mar 1985. 94p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE85751610.

The report under review is part of the project 'Ceramic Materials for Automobile Gas Turbines', which has been sponsored by the Ministry for Research and Technology of the Federal Republic of Germany since 1974 and describes the works in the years from 1980 to 1983. Special effort has been made in the improvement of silicon nitride concerning oxidation resistance and strength, suitable production techniques such as foil casting, injection moulding, extrusion and isostatic pressing as well as the manufacturing of structural components with improved material data for test purposes. With this the tight connection of production techniques, construction and testing in simulated application conditions was proved.

25837 **(BMFT-FB-T—85-016) Development of high-temperature resistant noncorrodible silicon-carbide components for gas turbine application. Follow-up-report.** Blecha, M.; Pohlmann, H.J. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Mar 1985. 66p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE85751611.

The report under review describes the work of phase 3 (1980 - 1983) of the project 'Ceramic Materials for Automobile Gas Turbines', which has been sponsored by the Ministry for Research and Technology of the Federal Republic of Germany since 1974. Special effort has been put on the improvement of different silicon carbide materials and suitable production techniques for the production of static gas turbine components and a heat exchanger prototype. Tight connection of production techniques, construction and testing in simulated application conditions made it possible to transfer improved material data from test specimens to structural components. Prototypes of combustion chambers, heat exchangers were produced and tested. The positive results of this R+D-project lead to the series production of silicon carbide components for engineering.

25838 **(BNL—36289) Low-temperature positron lifetime and Doppler-broadening measurements for single-crystal nickel oxide containing cation vacancies.** Waber, J.T.; Snead, C.L. Jr.; Lynn, K.G. (Northwestern Univ., Evanston, IL (USA); Brookhaven National Lab., Upton, NY (USA)). 1985. Contract AC02-76CH00016. 5p. (CONF-850169—8). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010238.

From 7. international conference on positron annihilation; New Delhi, India (6 Jan 1985).

Lifetime and Doppler-broadening measurements for positron annihilation in substoichiometric nickelous oxide have been made concomitantly from liquid-helium to room temperature. The concentration of cation vacancies is readily controlled by altering the ambient oxygen pressure while annealing the crystals at 1673°K. It was found that neither of the three lifetimes observed or their relative intensities varied significantly with the oxygen pressure, and the bulk rate only increased slightly when the specimen was cooled from room to liquid-helium temperatures. These results are interpreted as indicating that some of the positrons are trapped by the existing cation vacancies and a smaller fraction by vacancy clusters.

25839 **(BNL—36350) Debye temperature and static displacements in LuH/sub x/ single crystals from energy dispersive x-ray diffraction.** Metzger, T.H.; Vajda, P.; Daou, J.N. (Brookhaven National Lab., Upton, NY (USA)). 1985. Contract AC02-76CH00016. 21p. (CONF-850303—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010961.

From International symposium on hydrogen in metals; Belfast, Northern Ireland (26 Mar 1985).

Integrated Bragg intensities of LuH/sub x/ along the hexagonal c-direction have been measured by energy-dispersive x-ray diffraction as a function of temperature and hydrogen concentration x $\leq$ 0.133 H/Lu. From the temperature-dependent measurements we show the Debye temperature Θ/sub D/ to increase linearly with the hydrogen content $\Delta\Theta$/sub D//Δx = 0.75K/% H/Lu. For pure Lu we find Θ/sub D/ = 157K +- 1K. From static Debye-Waller factor measurements (at T = 17K) we determined the displacements of the Lu atoms close to hydrogen on tetrahedral sites (u/sub 1st shell/ = 0.09 +- 0.002 A and u/sub 2nd shell/ = 0.03 +- 0.002 A. We demonstrate that the static Debye-Waller factor is not very sensitive to pair formation of hydrogen atoms. Therefore the measurements gave no indication of hydrogen pairs on adjacent tetrahedral sites.

25840 **(CONF-8504115—3) NMR investigation of crystalline electric field effect on spin-spin relaxation in (Y/sub 1-x/RE/sub x/)Rh_4B_4.** Kumagai, Ken-ichi; Kon, Kazuo; Fradin, F.Y. (Argonne National Lab., IL (USA); Hokkaido Univ., Sapporo (Japan). Dept. of Physics). Apr 1985. Contract W-31-109-ENG-38. 11p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010512.

From 5. international conference on crystalline field effects in f-electron systems: ICCF5; Sendai, Japan (15 Apr 1985).

Pulsed and cw-NMR measurements of ^{11}B have been used to study the spin dynamics of magnetic rare earth ions in (Y/sub 1-x/RE/sub x/)Rh_4B_4. We find the nuclear spin-lattice relaxation rate of ^{11}B induced by RE = Tb, Dy and Ho moments to be exponential in -Δ/T in the normal state, where Δ is the crystal field splitting of the first excited state. Anomalous temperature dependencies of the transverse relaxation time T_2, Knight shift and NMR line width in (Y/sub 1-x/Dy/sub x/) Rh_4B_4 are obtained in the temperature region where T_1 changes drastically. The results are discussed in terms of a model of the crystalline electric fields, in which thermal activation across Δ must take place for the Δm/sub J/ = +-1 transition to occur in highly anisotropic paramagnetic moments in the ternary superconductors.

25841 **(PNL-SA—12738) High temperature Raman studies of phase transitions in thin film dielectrics.** Exarhos, G.J. (Pacific Northwest Labs., Richland, WA (USA)). Apr 1985. Contract AC06-76RL01830. 18p. (CONF-850421—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010973.

From 2. spring meeting of the Materials Research Society; San Francisco, CA, USA (15 Apr 1985).

Rapid and unambiguous characterization of crystalline phases in submicron sputter deposited TiO_2 films on silica substrates can be inferred from measured Raman spectra. Pure anatase and rutile, mixed phase, and amorphous films to thicknesses of several hundred Angstroms and greater yield Raman spectra exhibiting little interference from the substrate when the appropriate component of the scattered light is analyzed. In situ Raman spectra were acquired as a function of temperature to 900°C using conventional radiant heating techniques and to temperatures near 2000°C using 10.6μ radiation from a CW CO_2 laser as a localized heating source. Pulsed Raman excitation/gated detection techniques were used to minimize blackbody radiation interference at these high temperatures. Anatase and amorphous TiO_2 films transform irreversibly to the rutile phase at temperatures below 900°C while rutile appears to be stable at much higher temperatures. Measurements performed on uncoated silica substrates at temperatures where the glass becomes fluid suggest that the strongly crosslinked glass has partially transformed into a chain-like structure.

25842 **Theory of the two-peak photoemission spectra in cerium pnictides.** Norman, M.R.; Koelling, D.D.; Freeman, A.J. (Materials Science and Technology Division, Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review [Section] B: Condensed Matter;* **31**: No. 10, 6251-6260(15 May 1985).

Cerium and many of its compounds exhibit a double-peaked photoemission spectrum arising from the 4f states. Considerable conjecture as to the origin of this phenomenon has given rise to numerous models for the electronic structure of these materials. In this paper we show that this phenomenon arises from the nature of the excitation process. The initial state including the f states are assumed to be adequately described by a band calculation. The possible final states are then simulated. Two primary channels occur for the f states which are characterized as the fully-screened—poorly-screened peaks: In the fully screened channel, the f hole is screened by f states; in the poorly screened channel, the f hole is screened by d states. As a first approximation, the fully screened final state is described with use of the ground-state density of states. The poorly screened final state is simulated by creating an f hole at a central atom in a large unit cell: a supercell technique which periodically repeats the screened hole at an adequate separation to minimize interaction of the holes. The separation of the two peaks in the photoemission spectra is then determined with use of Slater transition-state arguments. Peak separations are found to be 2.71 eV for CeSb and 2.47 eV for CeP which compare favorably with the experimental values of 2.5 and 2.4 eV, respectively. No stable d-screened f hole is found in CeN, in agreement with the fact that it is not observed.

25843 **Supercell calculation of the bremsstrahlung isochromat spectrum of cerium phosphide.** Norman, M.R. (Materials Science and Technology Division, Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review [Section] B: Condensed Matter;* **31**: No. 10, 6261-6263(15 May 1985).

The supercell technique with a local-density potential as described in the preceding paper is used to calculate the inverse photoemission spectrum of cerium phosphide. The results yield a double-peaked structure due to f states with one peak at 0.4 eV and another peak at 4.4 eV above the Fermi energy. Although bremsstrahlung isochromat spectroscopy has not yet been applied to CeP, the theoretical spectrum is very similar to experimental spectra of other cerium compounds. The peak at 0.4 eV is interpreted as a "fully relaxed" peak where the final state closely approximates the ground state (i.e., the f electron hops off the site involved). The second peak at 4.4 eV is due to a localized $f^1 \rightarrow f^2$ transition with associated repulsion of d charge off that site (antiscreening).

25844 **Effects of thermal treatments on the lattice properties and electronic structure of ZrH/sub x/.** Bowman R.C. Jr.; Craft, B.D.; Cantrell, J.S.; Venturini, E.L. (Mound Facility, Monsanto Research Corporation, Miamisburg, Ohio 45342). *Physical Review [Section] B: Condensed Matter;* **31**: No. 9, 5604-5615(1 May 1985).

In order to examine possible sources of the discrepancies between the proton NMR parameters for ZrH/sub x/ as reported by R. C. Bowman, Jr., et al. [Phys. Rev. B 27, 1474 (1983)] and C. Korn [Phys. Rev. B 28, 95 (1983)], proton spin-lattice relaxation times (T_1), lattice parameters, and magnetic susceptibilities (chi) have been measured for high-purity ZrH/sub x/ samples in the composition range 1.5< or =x< or =1.9 that had been typically annealed at 525 °C for 21 d. When these results are compared with the corresponding parameters obtained on the as-prepared ZrH/sub x/ samples of Bowman et al. it was found that the anneals generally had only minor effects on the proton T_1 values, lattice parameters, or chi(T) behavior. The most notable exception is a ZrH/sub 1.70/ sample that was initially composed of a mixture of δ(fcc) and ϵ(fct) phases and converted to just the ϵ phase upon annealing. Although the anneals gave small systematic decreases in the unit-cell volumes, the tetragonal distortions (i.e., c/a ratios) were not affected within experimental accuracy. Furthermore, both the proton (T_1T)/sup -1/2/ peak and T_1T temperature dependences were also not significantly changed by these anneals. Although the chi(T) values in the ϵ phase decrease rapidly with increasing hydrogen content, a local chi(T) maximum that reflects the Pauli component from a peak in the Fermi-level density of states is observed near x = 1.80.

25845 **Magnetic and superconducting properties of holmium-rich (Er/sub 1-x/Ho/sub x/)Rh_4B_4.** Lynn, J.W.; Gotaas, J.A.; Shelton, R.N.; Horng, H.E.; Glinka, C.J. (Department of Physics, University of Maryland, College Park, Maryland 20742 and Center for Materials Research, National Bureau of Standards, Gaithersburg, Maryland 20899). *Physical Review [Section] B: Condensed Matter;* **31**: No. 9, 5756-5767(1 May 1985).

Neutron scattering, susceptibility, and resistivity measurements have been carried out on (Er/sub 1-x/Ho/sub x/)Rh_4B_4 for concentrations x = 1.0, 0.89, 0.84, and 0.75, which span the "multicritical" point (x/sub c/roughly-equal0.9) where the magnetic and superconducting phase boundaries meet. For all concentrations studied a transition to long-range ferromagnetic order is observed, with the Ho moments ordering along the tetragonal axis. The spins are in fact locked along the c axis by strong crystal-field anisotropies, yielding Ising-like magnetic behavior in this concentration region. The temperature dependence of the order parameter is mean-field-like, suggesting that the range of the magnetic interactions is large, and we attribute this behavior to the importance of dipolar interactions. In the concentration range x<x/sub c/ where superconductivity is observed, the magnetic transition appears to be continuous

25846 **Method for the preparation of photochromic insulating crystals.** Abraham, M.M.; Boldu, J.L.; Chen, Y.; Orera, V.M. (to Dept. of Energy). US Patent Application 6-655,592. 28 Sep 1984. 23p. Contract AC05-84OR21400.

A method for preparing reversible-photochromic magnesium oxide (MgO) crystals is disclosed. Single crystals of MgO doped with both lithium (Li) and nickel (Ni) are grown by a conventional arc fusion method. The as-grown crystals are characterized by an amber coloration. The crystals lose the amber coloration and become photochromic when they are thermochemically reduced by heating at temperatures greater then 1000°K in a hydrogen atmosphere. Alternate irradiation with uv and visible light result in rejuvenation and bleaching of the amber coloration, respectively.

25847 **Raman spectroscopy of high temperature phase transitions in non-stoichiometric zirconia-yttria mixed crystals.** Perry, C.H.; Liu, D.W. (Northeastern Univ., Boston, MA). pp 441-442 of Raman spectroscopy - linear and nonlinear. Lascombe, J.; Huong, P.V. (eds.). New York, NY; John Wiley & Sons (1983). Contract AC02-81ER10866.

Raman spectroscopy has proved to be a valuable tool for studying the phase transitions in mixed crystals of ZrO_2 - Y_2O_3. The spectra uniquely describe the structural modifications and the mixed phase regions as the Y_2O_3 content and the temperature are varied. Light scattering data have been obtained from in situ studies of materials varying from 0-20 wt% Y_2O_3 over the temperature range 4-1900°K.

25848 **High temperature failure in ceramics.** Evans, A.G.; Blumenthal, W. (Lawrence Berkeley Lab., CA). pp 423-448 of Fracture mechanics of ceramics. Volume 6. Bradt, R.C.; Evans, A.G. (eds.). New York, NY; Plenum Publishing Corporation (1983). Contract W-7405-ENG-48.

The failure of ceramics at elevated temperatures, accompanied by creep deformation, is substantially more complex than the brittle fracture process that prevails at lower temperatures. The failure typically involves a crack nucleation and a crack propagation stage. Both phenomena are associated with either diffusive cavitation or viscous hole growth. A framework suitable for the analysis and interpretation of the crack initiation and crack growth stages of failure is presented. Those aspects of the failure process that are relatively well comprehended are described in some detail, and current deficiencies in knowledge are emphasized. 28 references, 20 figures.

25849 **Jahn-Teller resonance states in the Vb metal hydrides.** Abell, G.C. (Monsanto Research Corp., Miamisburg, OH). pp 379-383 of Electronic structure and properties of hydrogen in metals. Jena, P.; Setterthwaite, C.E. (eds.). New York, NY; Plenum Publishing Corporation (1982). Contract AC04-76DP00053.

A Hamiltonian with a localized Jahn-Teller electron-phonon interaction plus a band-coupling term belonging to a metal cluster state adjacent to interstitial hydrogen in the Vb metals is presented. It is shown that in a low-frequency approximation, this Hamiltonian is analogous to the Anderson Hamiltonian for magnetic impurities in metals. The role of hydrogen in triggering the Jahn-Teller instability is explained in the context of the Hartree-Fock solutions of the low-frequency Hamiltonian, using a phase diagram in the Hartree-Fock parameter space. An elastic susceptibility expression is derived and compared with an observed elastic relaxation. The empirical connection of the Jahn-Teller distortion to the observed elastic dipole tensor is reconsidered. 11 references, 1 figure.

3603 Composite Materials

25850 **(MRP/MRL—82-77) Diffusion properties of a synthetic porous material to radon gas.** Bigu, J. (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada)). Aug 1982. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700591.

The diffusion properties of a synthetic porous material to radon gas have been studied in a radon/thoron room calibration facility. The material tested is known under the commercial name Vyon. Experimental data indicate that for the thickness tested Vyon introduces a delay in the diffusion of radon of the order of 120 min in dry conditions, and substantially longer under wet conditions.

25851 **Neutron irradiation effects on the mechanical properties of organic composite materials.** Egusa, S.; Kirk, M.A.; Birtcher, R.C. (Argonne National Lab., IL (USA). Materials Science and Technology Div.). *Journal of Nuclear Materials;* **126**: No. 2, 152-159(Oct 1984).

Neutron irradiations with low γ-ray flux in the Intense Pulsed Neutron Source were carried out on four kinds of cloth-filled organic composites (filler: E-glass or carbon fiber; matrix: epoxy or polyimide resin) and a unidirectional alumina fiber/epoxy composite. These composites were examined with regard to the mechanical properties at room temperature. Following irradiation at room temperature, the Young's (tensile) modulus of these composites remains practically unchanged up to a total neutron fluence of 5.0×10^{18} n/cm² (1.4×10^{18} n/cm² for $E > 0.1$ MeV). The shear modulus and the ultimate strength, on the other hand, decrease significantly at this neutron fluence for the glass/epoxy and glass/polyimide composites, whereas for the other composites both properties do not degrade. This result is most likely ascribed to the radiation damage at fiber/matrix interface due to recoil particles produced by a $^{10}B(n,\alpha)^7Li$ reaction in the boron-containing E-glass fibers. Only for the E-glass fiber composites, in fact, the fracture propagation energy is appreciably increased by irradiation, while for the other composites the propagation energy is scarcely changed, thus confirming the significant contribution due to the ^{10}B reaction. As to the 5 K irradiation, degradation of the present composites was not observed up to a total neutron fluence of 1.0×10^{18} n/cm² (7.0×10^{17} n/cm² for $E > 0.1$ MeV) when tested at room temperature.

3604 Polymers And Plastics

REFER ALSO TO CITATION(S) 25226, 25945, 25945

25852 **(DOE/ER/45031—1) Synthesis and characterization of novel polymers from non-petroleum sources for use in enhanced oil recovery. Final report, July 1, 1983-June 30, 1984.** Hogen-Esch, T.E. (Florida Univ., Gainesville (USA)). 1984. Contract AS05-83ER45031. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010922.

Accomplishments for the past year are discussed for grafting of acrylamide to: (1) starch and related polysaccharides; and (2) cellulose solutions. In grafting acrylamide to various polysaccharide substrates such as okra polysaccharide, yellow dextrin, waxy corn starch, potato amylose, gum arabic, the efficiency of Ce^{4+} as initiator was found to vary from 0.02 to 0.89, depending on reaction conditions. Okra polysaccharide was isolated, characterized, and evaluated for use in enhanced oil recovery. A series of experiments designed to increase the viscosifying power of certain polymers by chain extension techniques has also been conducted. Characterization of the polymers by ultracentrifugation, size exclusion chromatography, membrane filtration, multi-cell equilibrium dialysis, and rheological studies has also been done. In grafting of acrylamide to cellulose solutions the following two courses were taken: (1) dissolution of cellulose in 70% aqueous zinc chloride, followed by Ce^{4+} initiated grafting of acrylamide, and (2) introduction of a 1,2-diol substituent onto the anhydroglucose units of the cellulose chain via dissolution of cellulose in concentrated aqueous NaOH, followed by treatment with glyceryl chlorohydrin. Considerable progress has been made via both approaches. 11 refs., 1 fig., 1 tab.

25853 **(SAND—85-0402) Mass spectrometer based gas permeation apparatus.** Keenan, M.R.; Reich, J.E. (Sandia National Labs., Albuquerque, NM (USA)). Apr 1985. Contract AC04-76DP00789. 31p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85011176.

A newly constructed instrument to measure diffusion and permeation rates in polymeric materials is described. This instrument utilizes a quadrupole mass spectrometer as a sensitive flow meter to detect the flux of gas through a polymer sheet that is subjected to a pressure gradient. The permeation coefficient is obtained from the steady state flux and the diffusion coefficient from the ki-

netics of reaching the steady state in a sheet that is initially devoid of permeant. The diffusion coefficient depends solely on the time development of the mass spectrometer signal and calibration is not required. To obtain the actual flux, however, the mass spectrometer output is calibrated by effusing a known quantity of the test gas into the spectrometer through an orifice. Enclosure of the sample cell in an oven permits the temperature dependences of the diffusion parameters to be derived. The instrument was tested by measuring the diffusion behavior of helium in ethylenepropylene rubber as a function of temperature and the results agree well with literature values.

25854 **Effect of longitudinal dipoles in liquid crystals.** Dowell, F. (Theoretical Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review [Section] A: General Physics;* 31: No. 5, 3214-3219(May 1985). Contract W-7405-ENG-36.

Molecular-lattice-theory results for rigid cores having partially-flexible tails reveal that it is not necessary to invoke dipolar forces to have stable smectic-A_1, smectic-A/sub d/, and low-temperature nematic (including reentrant-nematic) liquid-crystal phases. However, dipolar forces increase the stability of these phases in systems with Lennard-Jones interactions. Dipolar forces also shift the temperature ranges of these phases closer to ambient, thus making them easier to discover and observe experimentally.

3606 Other Materials

REFER ALSO TO CITATION(S) 25408, 25425, 25426, 25432, 25433, 25618, 25851

25855 **(AD-A—149747/8/XAB) Investigation of device and electronic interactions in GaAs device processing. Annual technical report, 15 August 1983-14 August 1984.** Gatos, H.C.; Lagowski, J. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Materials Science and Engineering). 14 Aug 1984. 11p. NTIS, PC A02/MF A01.

This was designed as a three-year program with first-year tasks focusing on the effects of thermal annealing. During this one-year period the design of the annealing ampull was modified in order to achieve stoichiometry-controlled annealing conditio; also, construction of the ultra-high-purity annealing apparatus was completed. The study of as-grown and annealed GaAs crystals led to the identification of new defect-related midgap levels. It was also discovered that defect interactions in a critical temperature range 800 C to 900 C are controlled by stoichiometry and by the Fermi energy. A collaborative study was initiated with Avionics Laboratory of the Wright Patterson Base on ion implantation and defect characterization by the photoluminescence technique, and results are presented.

25856 (CONF-8403124—Pt.1, pp 105-120) **Total energy method for solids and solid surfaces.** Chelikowsky, J.R.; Louie, S.G.; Vanderbilt, D.; Chan, C.T. (Exxon Research and Engineering Co., Annandale, NJ; Lawrence Berkeley Lab., CA). 1984. NTIS, PC A99/MF A01. File Number DE85009401.

From Sanibel symposia; Palm Coast, FL, USA (1 Mar 1984).

We present a method for the computation of cohesive and structural properties of solids. The method is based on a local orbital description of the wave functions, an ab initio pseudopotential construction for the ion-core potential, and a local density treatment of exchange and correlation energies. Key elements of the method include the direct computation in real space of all the matrix elements, a noniterative evaluation of the total energy, and the transferability of the total electronic potential. The combination of these elements allows an accurate, yet less complex, treatment of a wide variety of systems. We shall illustrate the method by considering several prototypical systems: the diamond crystal, the diamond (111) surface, the silicon crystal, and the molybdenum crystal. With respect to the bulk crystalline properties, i.e., the cohesive energy, the lattice constant, the bulk modulus, etc., we obtain state of the art agreement with experiment. With respect to the diamond surface, we have considered several models for the reconstructed 2 x 1 surface. Of the models considered, we find only the undimerized π-bonded chain reconstruction had a total energy lower than the relaxed 1 x 1 surface.

25857 **(IC—84/31) Structure and thermodynamic properties of molten alkali chlorides.** Ballone, P.; Pastore, G.; Tosi, M.P. (International Centre for Theoretical Physics, Trieste (Italy)). Mar 1984. 21p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700583.

Self-consistent calculations of partial pair distribution functions and thermodynamic properties are presented for molten alkali chlorides in a non-polarizable-ion model. The theory starts from the hypernetted chain approximation and analyzes the role of bridge diagrams both for a two-component ionic plasma on a neutralizing background and for a binary ionic liquid of cations and anions. A simple account of excluded-volume effects suffices for a good description of the pair distribution functions in the two-component plasma, in analogy with earlier work on one-component fluids. The interplay of Coulomb attractions and repulsions in the molten salt requires, on the other hand, the inclusion of (i) excluded-volume effects for the various ion pairs as in a mixture of hard spheres with non-additive radii and (ii) medium-range Coulomb effects reflected mainly in the like-ion correlations. All these effects are included approximately in an empirical evaluation of the bridge functions, with numerical results which compare very well with computer simulation data. A detailed discussion of the results against experimental structural data is then given in the case of molten sodium chloride.

25858 **(IC—84/56) Simple formula for the fundamental optical absorption of alkali halide melts.** Senatore, G.; Tosi, M.P.; Woodruff, T.O. (International Centre for Theoretical Physics, Trieste (Italy)). Jun 1984. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700584.

Significant similarities - with respect to absorption of ultraviolet - between the crystalline and liquid phases of the alkali halides are considered. It is shown that a simple formula which emerged from an earlier application of local electron transfer concepts to the fundamental absorption of the alkali halide crystals appears to apply equally well (i.e., within experimental error) to their melts. This formula fits the observations relating to the fundamental absorption of five molten alkali halides and yields predictions for all the others - which will, it is hoped, stimulate experimental activity.

25859 **(IPEN-Inf—12) Equations of state for light water.** Rubin, G.A.; Granziera, M.R. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). Jan 1983. 59p. (In Portuguese). NTIS (US Sales Only), PC A04/MF A01. File Number DE85700585.

The equations of state for light water were developed, based on the tables of Keenan and Keyes. Equations are presented, describing the specific volume, internal energy, enthalpy and entropy of saturated steam, superheated vapor and subcooled liquid as a function of pressure and temperature. For each property, several equations are shown, with different precisions and different degrees of complexity.

25860 **(LBL—18586) Structure and chemistry of sol-gel derived transparent silica aerogel.** Tewari, P.H.; Lofftus, K.D.; Hunt, A.J. (Lawrence Berkeley Lab., CA (USA)). Feb 1985. Contract AC03-76SF00098. 17p. (CONF-850267—5). NTIS, PC A02/MF A01; GPO Dep. File Number DE85009902.

From 2. international conference on ultrastructure processing of ceramics, glasses and composites; Daytona Beach, FL, USA (25 Feb 1985).

Transparent silica aerogels are being studied because of their excellent thermal insulation properties for window glazing materials. The chemistry of the base catalyzed $Si(OC_2H_5)_4$ sol-gel process to produce transparent aerogels is presented. The results of a factorial design set of experiments are discussed in which five process parameters are simultaneously varied. The goal of these experiments was to optimize the process conditions and to analyze the importance of various parameters in improving the properties of the aerogel. A novel technique of ambient temperature supercritical drying of alcogels is described. In this process, supercritical drying occurs at $\leqq$40°C instead of at $\geqq$270°C and $\geqq$1700 PSI (12 MPa), by substituting CO_2 for alcohol in the alcogel. The time of drying is reduced from 2 to 3 days to 8 to 10 hours. It is shown that light scattering, microstructural properties and other characteristics of

aerogels produced by this process and by the high temperature supercritical drying are similar.

25861 (LBL—19362) Ab initio calculations of materials properties. Louie, S.G. (Lawrence Berkeley Lab., CA (USA)). Sep 1984. Contract AC03-76SF00098. 32p. (CONF-8409210—2). NTIS, PC A03/MF A01; GPO Dep. File Number DE85011167.

From Texas A and M symposium on theory and modeling for materials design; College Station, TX, USA (17 Sep 1984).

Several important factors that contributed to making ab initio electronic structure calculations possible include better approximations to the density functional formalism, better band structure and total energy calculational techniques including the invention of ab initio pseudopotentials, and the availability of large and fast computers. A brief discussion of the theoretical methods is given and applications are discussed. In discussing applications, the bulk properties, which include the structural properties, solid-solid phase transformations, and vibrational properties, are presented first. Next, we describe calculations of microscopic interaction parameters between elementary excitations in the solid state. Phonon-phonon and electron-phonon interactions are used as examples. Then, we turn to surface structural determination and discuss the case of the 2 x 1 reconstruction on the diamond (111) surface. Finally, the possibility of calculating excited-state properties from first principles is discussed.

25862 (SAND—85-0444C) Determining peak stress history using acoustic emissions. Holcomb, D.J.; Martin, R.J. III. (Sandia National Labs., Albuquerque, NM (USA); Applied Research Associates, Inc., South Royalton, VT (USA). New England Div.). 1985. Contract AC04-76DP00789. 12p. (CONF-850671—8). NTIS, PC A02/MF A01; GPO Dep. File Number DE85007883.

From 26. U.S. symposium on rock mechanics; Rapid City, SD, USA (26 Jun 1985).

As part of the test program at the Nevada Test Site, there is a need for determining the peak stress induced by explosions in tuff. Standard techniques make use of various gages grouted into the tuff prior to the test. These are difficulties in interpreting the output of these gages and there is always the chance that the gage will not survive long enough to allow a stress determination to be made. As an alternative, we have been testing a passive technique for determining peak stress as a function of distance from a test. Using core samples retrieved from the vicinity of an explosion, we have tested for the existence of a threshold stress for the onset of acoustic emissions, the Kaiser effect (Kaiser 1950). From laboratory results it is known that for many rock types, the previously applied peak stress can be detected by restressing a sample while monitoring acoustic emissions. An abrupt onset for acoustic emission activity typically occurs at a stress state close to the previous peak. The point of this work was to determine if the Kaiser effect occurred in tuff and, if so, whether it could be used to determine the peak stresses induced by an explosion. On the basis of four tests it is only possible to draw tentative conclusions. There does seem to be enough evidence of the existence and stress dependence of the Kaiser effect in the tuff to allow hope for the use of this technique in studying past stress states. In future tests the saturation state of the samples should be carefully controlled. Tests should be done on variously oriented subcores from a main core to determine the other components of the in situ stress tensor. If the components are indeed decoupled, as these few tests indicate, then a complete stress determination can be made this way. It would be interesting to use the same technique to try and determine in situ stresses in tuff. 7 refs., 6 figs.

25863 Paramagnetic spin fluctuations in the weak itinerant-electron ferromagnet MnSi. Ishikawa, Y.; Noda, Y.; Uemura, Y.J.; Majkrzak, C.F.; Shirane, G. (Physics Department, Tohoku University, Sendai, 980, Japan). *Physical Review [Section] B: Condensed Matter;* **31**: No. 9, 5884-5893(1 May 1985). Contract AC02-76CH00016.

Paramagnetic spin fluctuations in the weak itinerant-electron ferromagnet MnSi have been measured by using both unpolarized and polarized neutron scattering, and the scattering intensity was put on an absolute value by the simultaneous measurements of phonon cross sections. The magnetic excitation spectra over the whole Brillouin zone, for a wide energy range from 0 to 20 meV ($\hbar\omega$/kT/sub c/ = 7.9) and up to temperatures (T/T/sub c/ = 10) well above T/sub c/, follow closely the Moriya-Kawabata self-consistent-renormalization theory for the weak itinerant-electron ferromagnet. Based on these experimental results, the origin of the increase in the amplitude of the local magnetic moment <M/sub L/^{2}> above T/sub c/ is attributed to the thermal excitations of the high-energy spin fluctuations in the Stoner continuum.

25864 Evidence for a novel chemisorption bond: Formate (HCO_2) on Cu(100). Stoehr, J.; Outka, D.A.; Madix, R.J.; Doebler, U. (Corporate Research Science Laboratories, Exxon Research and Engineering Company, Annandale, New Jersey 08801). *Physical Review Letters;* **54**: No. 12, 1256-1259(25 Mar 1985).

Surface extended-x-ray-absorption fine-structure measurements reveal that formate (HCO_2) groups on Cu(100) chemisorb via the two oxygen atoms in adjacent fourfold hollow sites with an average O-Cu nearest-neighbor bond length of 2.38 +- 0.03 A. This distance is sig- nificantly (~0.4 A) longer than typical O-Cu bonds in bulk compounds and all known surface complexes. The unusually large O-Cu distance is attributed to a steric effect involving the C atom in HCO_2 and the nearest-neighbor Cu surface atoms.

25865 Ambient-pressure superconductivity at 2.7 K and higher temperatures in derivatives of (BEDT-THF)$_2$IBr$_2$: synthesis, structure, and detection of superconductivity. Williams, J.M.; Wang, H.H.; Beno, M.A.; Emge, T.J.; Sowa, L.M.; Copps, P.T.; Behroozi, F.; Hall, L.N.; Carlson, K.D.; Crabtree, G.W. (Argonne National Lab., IL). *Inorganic Chemistry;* **23**: No. 24, 3839-3841(21 Nov 1984). Contract W-31-109-ENG-38.

The synthesis and structure of the first mixed polyhydride derivative of bis(ethylenedithio)tetrafulvalene (ET) derived from the ET-IBr$_2$ system and having the highest transition temperature (T/sub c/ ~ 2.7K) and a metastable state at approximately 4.2K yet observed in an organic semiconductor are reported. Strategy for the design of new organic synthetic metals with possible high superconducting transition temperatures for the onset of superconductivity is presented.

25866 Theoretical and experimental studies of shock-compressed benzene and polybutene. Ree, F.H.; Nellis, W.J.; Trainor, R.J.; Mitchell, A.C.; Boslough, M.B. (Lawrence Livermore National Lab., CA). pp 41-43 of Shock waves in condensed matter - 1983. Asay, J.R.; Graham, R.A.; Straub, G.K. (eds.). New York, NY; Elsevier Science Publishers B.V. (1984). Contract W-7405-ENG-48.

The authors report experimental and theoretical studies on shock pressure, volume, and temperature of liquid polybutene and benzene over the pressures ranges 19-210 GPa and 39-70 GPa, respectively. Analysis of the (P-V) Hugoniot data is consistent with a model which assumes hydrocarbons to be decomposed into a dense diamond-like phase and hydrogen in the molecular phase. The measured radiating temperatures of the shock front are substantially lower than the theoretical values and a possible reason is discussed. Chemical equilibrium calculations which include up to 12 species suggest the presence of small concentrations of several high-molecular-weight species.

40 CHEMISTRY

25867 Polymers and Random graphs: Asymptotic equivalence to branching processes. Spouge, J.L. (Theoretical Biology and Biophysics, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Statistical Physics;* **38**: No. 2, 573-668(Feb 1985).

In 1974, Falk and Thomas did a computer simulation of Flory's Equireactive RA/sub f/ Polymer model, rings forbidden and rings allowed. Asymptotically, the Rings Forbidden model tended to Stockmayer's RA/sub f/ distribution (in which the sol distribution "sticks" after gelation), while the Rings Allowed model tended to the Flory version of the RA/sub f/ distribution. In 1965, Whittle introduced the Tree and Pseudomultigraph models. We show that these random graphs generalize the Falk and Thomas

models by incorporating first-shell substitution effects. Moreover, asymptotically the Tree model displays postgelation "sticking." Hence this phenomenon results from the absence of rings and occurs independently of equireactivity. We also show that the Pseudomultigraph model is asymptotically identical to the Branching Process model introduced by Gordon in 1962. This provides a possible basis for the Branching Process model in standard statistical mechanics.

4001 Analytical And Separations Chemistry

REFER ALSO TO CITATION(S) 25289, 25301, 25337, 25338, 25339, 25348, 25349, 25350, 25778, 25778, 26098, 26117

25868 (CONF-8303106—, pp 299-314) **Multi-element determination in sludges and soils by means of atom emission spectroscopy.** Bortlisz, J.; Krone, R. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE85770201.

From 16. Essen meeting on sewage sludge - raw material or pollutant; Essen, F.R. Germany (9 Mar 1983).

The analytical requirements necessitated by the sewage sludge ordinance can be readily solved by multi-element Atomic Emission Spectrometry. From the nitro-hydrochloric acid extraction of the sewage sludge and the soil, six of the seven heavy metals stipulated as well as the nutrient elements calcium, magnesium, potassium and phosphorous can be analysed simultaneously in one experimental run. Only nitrogen and mercury cannot be analysed, the latter due to the unsatisfactory sensitivity of the AES method for this element. Experiences are presented on a simultaneous atomic emission spectrometer with an inductively coupled argon plasma. The operating mode, comparative investigations with conventional methods of analysis as well as possible malfunctions are also considered. As compared to atomic absorption and other conventional methods, the savings in time are relatively high. Another advantage of simultaneous multi-element analysis is the possibility of analysing elements not stipulated in the decree without much extra effort. The increased information thus available, together with the possibility of frequent tests due to rapid analysis make the agricultural use of sewage sludge more secure.

25869 (CONF-8303106—, pp 315-332) **Identification and determination of organic pollutants in sewage sludges from various sources.** Anna, J.; Ploeger, E.; Reupert, R. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE85770201.

From 16. Essen meeting on sewage sludge - raw material or pollutant; Essen, F.R. Germany (9 Mar 1983).

For the analysis of sludges, preparation and detection methods have been developed during the past years that allow the analysis of specific groups of substances. However, to date little is known about possible methods for the analysis of the complete organic or toxic contents of sewage sludges. Combined methods for sample preparation, concentration and separation must be carried out. In addition to the coupled system gas chromatograph-mass spectrometry, high resolution fluid chromatography is also an important process. On the one hand, this method gives optimum results for certain groups of substances, on the other mixtures of less volatile substances can be separated into fractions that can then be identified with mass spectrometry. It is investigated whether the results allow statements on specific toxic agents in sewage sludges of different origins. The results are specially important with regard to the eventual expansion of the sewage sludge ordinance to include organic contents.

25870 **(IPEN-Pub—56) Determination of mercury in ppb level by activation analysis and chemical separation.** Requejo, C.S. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). Feb 1983. 8p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. File Number DE85700579.

A method for determining mercury in steel samples was developed. Activation analysis using thermal neutrons, followed by radiochemical separations to eliminate ^{75}Se interferences, were applied. Sixty hours after the end of the irradiation, the samples were processed and distillation of mercury and selenium bromides were carried out. Selenium was separated as an element and mercury sulfide was precipitaded. The chemical separation procedure was tested by using a tracer technique; the recovery yield was 99,2% +- 2,7%.

25871 **(IPEN-Pub—57) Spectrographic determination of trace amounts of some elements in metallic aluminium.** Charbel, M.Y.; Lordello, A.R. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). Apr 1983. 20p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. File Number DE85700580.

A spectrographic method for the determination of twenty trace elements in aluminium metal by the carrier distillation technique has been developed. The following elements were considered: B, Cd, Bi, Cu, Fe, Mg, Mn, Cr, Pb, Si, Zn, Ti, Ca, Na, Ga, Ni, Sb, V, Sn and Ag. AgCl, In_2O_3, NaF, Ga_2O_3, GeO_2 and CuF_2 were tested as carriers. The best results were obtained by using 2% In_2O_3 and 6% AgCl on an alumina base. Several aluminum oxide samples with the same chemical composition of aluminum sulfate and nitrate, according to a temperature program, were submitted to spectrochemical analysis. The standards were prepared by means of two different methods: dry mixing technique and thermal decomposition of aluminum nitrate at 800°C. Some considerations on matrix effects and on the extent to which it affects the accuracy of the method, are presented. The standard deviation of the method varies from +- 5% to +- 27%. The accuracy was examined with the aid of X-ray fluorescence technique.

25872 **(SAND—85-0087C) Quantitative passive technique for assay of near-surface tritium in materials.** Pregenzer, A.L.; Kerst, R.A. (Sandia National Labs., Albuquerque, NM (USA); Lawrence Livermore National Lab., CA (USA)). 1985. Contract AC04-76DP00789. 8p. (CONF-850507—5). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010661.

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

The electrons emitted when tritium β decays can be used to determine the amount of near-surface tritium in materials. A tritium-contaminated sample is placed near a channel electron multiplier (CEM) in a vacuum chamber. If information is available about the depth distribution of tritium in the material, energy analysis of the electrons emerging from the surface allows an absolutely calibrated, noninvasive assay of the amount of tritium near this surface. The assay apparatus is described and the method for relating the CEM counting rate of a given sample to its tritium content is explained. Comparisons with experiment are presented.

25873 **Liquid chromatographic determination of phenol and cresols in totoal particulate matter of cigarette smoke.** Tomkins, B.A.; Jenkins, R.A.; Griest, W.H.; Reagan, R.R.; Holladay, S.K. (Oak Ridge National Lab., TN). *Journal of the Association of Official Analytical Chemists;* 67: No. 5, 919-923(Sep-Oct 1984). Contract W-7405-ENG-26.

The phenol and cresol contents of the total particulate matter of tobacco smoke can be conveniently determined. A simple extraction procedure using 1N base is followed by partial neutralization with glacial acetic acid and elution of hydroxybenzenes from an end-capped reverse phase liquid chromatographic column. The procedure is rapid (20 min/sample after the initial extraction), precise (+ / - 10% relative standard deviation), accurate, and convenient. Normally, 12 or fewer cigarettes are needed for a single measurement. 18 references, 1 figure, 4 tables.

25874 **Linear algebraic approach to electron-molecule collisions.** Schneider, B.I.; Collins, L.A. Deerfield Beach, FL; Verlag Chemie International Inc. (1983). 9p. Verlag Chemie International Inc., 303 NW 12 Ave., Deerfield Beach, FL 33441.

The various levels of sophistication of the linear algebraic method are discussed and its application to electron-molecule collisions of H_2, N_2 LiH, LiF and HCl is described. 13 references, 2 tables.

25875 **Photothermal detection of NO_2.** Lin, H.B.; Fluckiger, D.U. (Brookhaven National Lab., Upton, NY). *Microbeam Analysis;* 526-528(1982). Contract AC02-76CH00016.

Recently an ultrasensitive photothermal technique, called phase fluctuation optical heterodyne (PFLOH) spectroscopy, has been developed for characterization of weakly absorbing species. This technique has been used successfully for studying microwave absorption characteristic of liquid, for the time dependence of intramolecular relaxation processes in gases, and for the in-situ trace detection of atmospheric pollutant gases and aerosols. In this paper, the authors describe a new version of a PFLOH apparatus that employs visible laser radiation for sample excitation. Hence, these measurements are extended to this spectral region. Preliminary experiments on NO_2 have achieved sensitivity of one part per million and better. 10 references, 1 figure.

4002 Inorganic And Physical Chemistry

REFER ALSO TO CITATION(S) 25288, 25384, 25397, 25890, 25893, 25894, 25895, 25900, 26447, 26448

25876 **(DOE/ER/10425—13) Variational transition state theory. Progress report, February 1983-February 1985.** Truhlar, D.G. (Minnesota Univ., Minneapolis (USA). Dept. of Chemistry). Mar 1985. Contract AC02-79ER10425. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010685.

We have pursued several projects involving the variational transition state theory (VTST) of chemical reaction rates and related theories. Progress has included both theoretical method development and applications. We have developed a more unified approach to calculate tunneling probabilities and a trajectory-based correction for recrossing effects, and we have improved the computational apparatus for handling vibrations and energy averaging. We have also made practical rate constant calculations, employing model potential surfaces and ab initio surfaces, for several kinds of systems, and we have studied the systematics of kinetic isotope effects. Further details of these studies carried out in the last two years are presented.

25877 **(DOE/PC/20080—T1) ESCA and SIMS-ISS characterization of cobalt promoted molybdena catalysts. Final technical report.** (Pittsburgh Univ., PA (USA)). 1980. Contract AC22-79PC20080. 35p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85010197.

The catalysts used most frequently for hydrodesulfurization is a molybdenum supported on γ-Al_2O_3 catalyst with Co or Ni present as a promoter. Although much research has been aimed at understanding these catalytic systems, the literature reveals contradictions of results and interpretations. Many factors account for this present state of affairs, particularly the method of catalyst preparation. Hence, it is not always legitimate to interpret data based on the results of other workers. In this vein, application of a wide variety of techniques to characterization of a single catalyst series is desirable. This report describes chemical preparation, reduction and sulfidation of cobalt promoted molybdena catalysts. The catalysts were then characterized by a variety of techniques. All ESCA spectra showing binding energies of catalysts were taken on an AEI ES 200A electron spectrometer interfaced to an AEI DS100 data system. ISS analysis was performed on a 3M model 525 spectrometer. An in-house photoacoustic spectrometer at the University of Denver was used to obtain PAS spectra. Results are discussed. 22 refs., 12 figs., 4 tabs.

25878 **(DOE/PC/60779—6) Advanced NMR characterization of zeolite catalysts. Sixth quarterly report, 1 January 1985-31 March 1985.** Welsh, L.B. (Signal UOP, Inc., Des Plaines, IL (USA). Research Center). Apr 1985. Contract FG22-83PC60779. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010143.

The program discussed in this report is a two-year two-phase joint UOP-University of Illinois study of the application of improved high resolution solid state nuclear magnetic resonance (NMR) techniques to the characterization of zeolite catalysts. During the first phase of this program very pure, and in some cases isotopically enriched faujasites will be prepared and studied by magic angle sample spinning NMR (MASS NMR) and variable angle sample spinning NMR (VASS NMR) on 500 and 360 MHz (proton frequency) NMR spectrometers. The NMR techniques that will be emphasized are the measurement and analysis of the ^{17}O NMR properties, ^{27}Al NMR intensity quantitation, and ^{27}Al and ^{29}Si NMR relaxation rates. During the second phase of this program these NMR techniques will be used to study the effects of impurity concentration, dealumination treatments and cation exchange on the NMR properties of faujasites. The initial emphasis of this program during Phase I is on the preparation and measurement of the NMR properties of ^{17}O enriched Na-Y faujasites. The effort in each phase is broken into four tasks: (1) zeolite preparation; (2) standard zeolite characterization; (3) measurement of zeolite NMR properties; and (4) analysis of NMR data. The main efforts during the sixth three-month period of the program have been in five areas: (1) Manuscript preparation of the ^{17}O NMR results for faujasites, (2) Synthesis of Ga substituted faujasites, (3) Synthesis of ^{17}O enriched AlPO-n microporous materials, (4) Preliminary ^{17}O NMR studies of ^{17}O enriched $AlPO_4$-5, and (5) Preliminary spin-lattice relaxation rate measurements of ^{17}O enriched zeolites. 8 refs., 1 fig.

25879 **(LBL—14996) Hydrolysis, formation and ionization constants at 25°C, and at high temperature-high ionic strength.** Phillips, S.L.; Phillips, C.A.; Skeen, J. (Lawrence Berkeley Lab., CA (USA)). Feb 1985. Contract AC03-76SF00098. 390p. NTIS, PC A17/MF A01; 1; GPO Dep. File Number DE85010645.

Thermochemical data for nuclear waste disposal are compiled. The resulting computerized database consists of critically evaluated data on Gibbs energy of formation, enthalpy of formation, entropy and heat capacity of selected substances for about 16 elements at 25°C and zero ionic strength. Elements covered are Am, As, Br, C, Cl, F, I, Mo, Np, N, O, P, Pu, Si, Sr, S, and U. Values of these thermodynamic properties were used to calculate equilibrium quotients for hydrolysis, complexation and ionization reactions up to 300°C and 3 ionic strength, for selected chemical reactions.

25880 **(SAND—84-2187C) Colloidal particle transport with simultaneous birth, growth, and capture.** Bonano, E.J.; Beyeler, W.E. (Sandia National Labs., Albuquerque, NM (USA); OAO Corp., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 12p. (CONF-850406—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010388.

From International symposium and workshop on particulate and multi-phase processes and the 16th annual meeting of the Fine Particle Society; Miami Beach, FL, USA (22 Apr 1985).

The simultaneous transport, birth, growth, and capture of colloidal particles suspended in a fluid within a parallel-plate channel was investigated. Growth and dispersion along the size axis were treated in the same fashion as convection and diffusion along a space coordinate axis. The capture and transport rates were given in terms of an average Sherwood number and average overall particle velocity relative to the fluid's velocity, respectively. The effects of changes in size dispersivity and fluid velocity on the capture and transport rates were significant. The opposite was the case for changes in the particle growth rate. Under all conditions considered here, the particle front had a higher average velocity than the fluid. 9 refs., 8 figs.

25881 **(SAND—84-2606C) Statistical mechanics of adsorption and wetting.** Davis, H.T.; Benner, R.E. Jr.; Scriven, L.E.; Teletzke, G.F. (Minnesota Univ., Minneapolis (USA). Dept. of Chemical Engineering and Materials Science; Sandia National Labs., Albuquerque, NM (USA); Exxon Production Research Co., Houston, TX (USA)). 1984. Contract AC04-76DP00789. 59p. (CONF-8407121—2). NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85010093.

From 5. international symposium on surfactants in solution; Bordeaux, France (9 Jul 1984).

The adsorption and wetting behavior of fluids on solid surfaces and at fluid-fluid interfaces are consequential in numerous natural processes and technological applications. Though the scientific study of the subject is old, going back to the early nineteenth century when Young and Laplace identified the laws of capillarity, the

molecular theory of interfacial phenomena is still a developing subject. It has been given a rigorous statistical mechanical foundation through the now classic works of Kirkwood, Buff and coworkers, the recent progress in the density functional theory of inhomogeneous systems, and the renormalization group theory of critical phenomena. It is interesting that perhaps the most fruitful development in the theory of interfacial phenomena has been the revival of the mean field theory of van der Waals. While not rigorous, this theory is tractable, has provided the insight and motivation for many useful new theories, and captures most of the known qualitative patterns of interfacial behavior, except for details near a critical point where renormalization group theory is required. Because of its simplicity and qualitative successes, we have chosen to use van der Waals theory as the main vehicle for presentation of an overview of our current understanding of adsorption and wetting. 52 refs., 25 figs.

25882 **Oxidation of rhodium field-emitter surfaces during the CO oxidation reaction.** Kellogg, G.L. (Sandia National Labs., Albuquerque, NM). *Journal of Catalysis;* **92**: No. 1, 167-172(Mar 1985). Contract AC04-76DP00789.

The oxidation of Rh field-emitter surfaces during the CO oxidation reaction has been investigated by imaging atom-probe mass spectroscopy. Rhodium samples were heated to 500 K in various mixtures of O_2 and CO at total pressures between 1 and 2 torr (1 torr = 133.3 N m^{-2}) and were subsequently transferred under ultrahigh vacuum to the atom probe for analysis. Surface oxides were detected when the O_2/CO ratio was 40/1 or greater, but not when the ratio was 30/1 or less. The 40/1 ratio correlates with the ratio where deactivation of the reaction has been observed, and the results provide direct evidence that oxide formation is the surface process responsible for deactivation. Quantitative atom-probe analysis indicated that the oxide formed during the reaction is stoichiometric Rh_2O_3. 10 refs., 5 figs.

25883 **Normal Unenhanced Raman Spectra of CO and CH_4 adsorbed on cobalt(poly).** Marzouk, H.A.; Bradley, E.B.; Arunkumar, K.A. (Department of Electrical Engineering, University of Kentucky, Lexington, Kentucky 40506-0046). *Spectroscopy Letters;* **18**: No. 3, 189-203(Mar 1985). Contract AS05-79ER10447.

Normal Unenhanced Raman Spectra (NURS) of low-polarizability CO molecules were observed for the first time on cobalt at R.T. and residual gas pressure. We assign five bands observed between 2030—2130 cm^{-1} to linear chemisorbed CO species, while those observed between 1840—2010 cm^{-1} have been ascribed to the 2—fold chemisorbed species. The three bands observed between 1740—1830 cm^{-1} we believe are due to the 3—fold species. The corresponding fourteen Co-C stretches were observed and assigned. A model based upon electron backdonation is proposed for each of the three structures. NURS were also observed at R.T. for physisorbed CH_4 and assignments are made to the four frequencies of CH_4.

25884 **Electronic structural model for the emitting MLCT excited states of Ru(bpy)$_3$2i and Os(bpy)$_3^{2+}$.** Kober, E.M.; Meyer, T.J. (Univ. of North Carolina, Chapel Hill). *Inorganic Chemistry;* **23**: No. 24, 3877-3886(21 Nov 1984).

A simple parametric model that includes spin-orbit coupling is developed for the localized metal to ligand charge transfer (MLCT) excited states of $M(bpy)_3^{2+}$ (M = Ru, Os; bpy = 2,2-bipyridine). In agreement with experimental data, it is found that there are three closely spaced (<200 cm^{-1}) low-lying states with a fourth state occurring several hundred cm^{-1} to higher energy. As has also been observed, it is predicted that emission from the lowest state is dipole forbidden. Complete state assignments are proposed on the basis of limited polarization data. In general, it is found that, for any Ru or Os bpy complex, no more than four low-lying MLCT states should be present.

25885 **Reactions of matrix-isolated iron atoms with dinitrogen.** Doeff, M.M.; Parker, S.F.; Barrett, P.H.; Pearson, R.G. (Univ. of California, Santa Barbara). *Inorganic Chemistry;* **23**: No. 24, 4108-4110(21 Nov 1984). Contract AM03-76SF00034.

The results of a study carried out to better characterize the product formed in the co-condensation reaction of iron with N_2 with regard to both the metal and ligand stoichiometry are reported. Results of ir and Mossbauer spectral studies and of concentration variation studies are presented. All data support the conclusion that the complex is a monomeric species, most likely $Fe(N)_8$. No evidence is furnished to support beliefs that the structure of such compounds differs significantly from their Fe/CO analogues.

25886 **Role of excited states of molecular ions in structure studies with high energy collisions.** Kanter, E.P. (Argonne National Lab., IL). pp 463-509 of Molecular ions. Berkowitz, J.; Groeneveld, K.O. (eds.). New York, NY; Plenum Publishing Corporation (1983).

The main features of the Coulomb explosion of fast-moving molecular-ions and the manner in which Coulomb-explosion techniques are being applied to the problem of determining stereochemical structures of light polyatomic ions have been described. Examples of such experiments have been presented for several ions. While these techniques are new, there is a growing effort to improve both the technology and the analysis techniques. These methods will surely make valuable contributions to the determination of molecular-ion structures in the years ahead. 48 references.

4003 Organic Chemistry

REFER ALSO TO CITATION(S) 25117, 25153, 25288, 25386, 25852, 25877, 25881, 25883, 25884, 26129, 26168

25887 **(AD-A—148551/5/XAB) Deuterium isotope effect on the compatibility between polystyrene and polybutadiene. Technical report.** Lin, J.L.; Rigby, D.; Roe, R.J. (Cincinnati Univ., OH (USA). Dept. of Materials Science and Metallurgical Engineering). 20 Nov 1984. 16p. (TR—12). NTIS, PC A02/MF A01.

The effect of deuteration of polystyrene on the miscibility behavior of polystyrene-polybutadiene blend systems was studied. A polystyrene having its aromatic hydrogens replaced by deuterium was prepared by starting from an ordinary polystyrene and treating it with deuterated benzene in the presence of an organometallic catalyst. A hydrogeneous polystyrene of closely similar structure was also prepared as a control by repeating the same procedure except that this time ordinary, rather than deuterated, benzene was used. These matching pairs of hydrogeneous and deuterous polystyrenes, when mixed with a polybutadiene or a styrene-butadiene random copolymer, were shown to give practically identical cloud point curves, thus indicating that the deuterium isotope effect is negligible.

25888 **(DOE/ER/10662—T2) Nature of odd-electron species and their role in catalytic processes. Progress report.** Filippo, J.S. Jr. (Rutgers--the State Univ., Newark, NJ (USA). Dept. of Chemistry). 20 Mar 1981. Contract AS05-80ER10662. 22p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010611.

ESR evidence is presented for the novel iron carbonyl radical anions $Fe_2(CO)_8^-$, $Fe_3(CO)_{11}$ and $Fe_4(CO)_{13}^-$. They are obtained either by alkali metal reduction of $Fe(CO)_5$ or by chemical oxidation of the corresponding carbonylate dianions in THF. The radical anion $Fe_3(CO)_{13}^-$ was also studied. ^{57}Fe and ^{13}C isotopic labelling studies greatly aided in the identification of these species as well as providing useful structural information. A novel series of radical anions, $[(\pi\text{-olefin})Fe(CO)_3]^-$, have been prepared and spectroscopically characterized (ESR). With activated olefins, e.g., maleic anhydride, these species are obtained by reaction of the olefin with $Na_2Fe(CO)_4$ or by reduction of the (π-olefin) $Fe(CO)_4$ complex with Na/K alloy or sodium napthalide in THF. A closely related series of iron carbonyl radical anions is obtained by similar reductions of $(diene)Fe(CO)_3$ complexes at low temperatures in THF/HMPA solutions. Isotopic labelling studies employing ^{57}Fe and ^{13}C were also carried out. 23 refs., 6 figs.

25889 (DOE/ER/13024—T2) Thermodynamic study of CO_2-organic compound interaction at high pressures and temperatures. Progress report, 15 September 1982-15 March 1985. Christensen, J.J.; Izatt, R.M. (Brigham Young Univ., Provo, UT (USA)). 1985. Contract AC02-82ER13024. 18p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010999.

The overall objective of this research program is to gain increased understanding of the energetics associated with chemical and physical interactions involving supercritical fluids. Emphasis has been placed on reactions involving CO_2, Freons, and hydrocarbons. Our approach to the accomplishment of this objective has been first, to measure heats of mixing (H/sup E/) for selected binary systems at temperatures and pressures in the vicinity of the critical points of one or both of the components. These experimental H/sup E/ data are incorporated into appropriate equations of state or modified equations of state in order to describe the variations in H/sup E/ with temperature and pressure. This process allows us to gain insight into the origin of the energy changes which occur. Since the energy changes are large and occur over a few degrees in some cases, the ability to predict them is necessary in designing equipment for use in carrying out supercritical fluid processes. In addition, H/sup E/ data in critical regions provide an excellent test for the validity of the equations used to describe these data. Several systems which illustrate these principles are presented and discussed in this report. These systems are (propane + CF_2Cl_2), (CO_2 + pyridine), (CHF_2Cl + N,N-dimethylacetamide). (CHF_2Cl + 2,3 dimethylbutane), (CF_2Cl_2 + N,N-dimethylacetamide), and (CF_2Cl_2 + ethane). 26 refs., 5 figs., 2 tabs.

25890 (IS-T—1168) Hydrodesulfurization catalysis by Chevrel phase compounds. McCarty, K.F. (Ames Lab., IA (USA)). Apr 1985. Contract W-7405-ENG-82. 316p. NTIS, PC A14/MF A01; GPO Dep. File Number DE85011359.

Thesis.

The catalytic activity of Chevrel phase compounds (M/sub x/Mo_6S_8) for thiophene hydrodesulfurization at 400°C has been found to be comparable to or greater than that of model industrial catalysts (unpromoted and cobalt-promoted MoS_2). The most active Chevrel phase catalysts were those containing the "large" ternary component cations Ho, Pb, Sn; the "intermediate" cation materials (M = Ag and In) were less active; the "small" cation materials (M = Cu, Fe, Ni, and Co) were the least active catalysts. The 1-butene hydrogenation activities of the Chevrel phase catalysts at 400°C were much lower than MoS_2, with the exception of Ni/sub 1.6/Mo_6S_8. X-ray powder diffraction and laser Raman spectroscopy analysis of the used catalysts revealed that the bulk structures were stable under reaction conditions. XPS analysis of the fresh Chevrel phase catalysts showed reduced molybdenum surface oxidation states compared to the Mo^{+4} state of MoS_2 catalysts. After thiophene reaction, various degrees of oxidation of the surface molybdenum states could be detected for the small and intermediate cation materials, with an accompanying loss of the ternary component from the surface. This was not the case for the large cation materials. Using a deuterium-thiophene feed at 400°C, the amount of deuterium incorporated into thiophene and into the desulfurization products was determined as a function of reaction time. For all Chevrel phase and MoS_2 catalysts examined, H_2S was almost exclusively formed. At the same levels of thiophene conversion, unpromoted MoS_2 introduced up to 10 times more deuterium into the nondesulfurized thiophene did the "promoted" catalysts. A mechanism of thiophene hydrodesulfurization is proposed: butadiene is the initial reaction product and the hydrogen of hydrogen sulfide originates from the hydrogen-exchange of thiophene. 140 refs., 87 figs., 30 tabs.

25891 Oxidative dehydrogenation of methanol to formaldehyde. Allison, J.N.; Goddard, W.A. III. (California Institute of Technology, Pasadena). *Journal of Catalysis;* **92**: No. 1, 127-135(Mar 1985).

Thermochemical results from ab initio quantum chemical calculations (generalized valence bond) are used to examine the reactions mechanism for $H_3COH + 1/2O_2 \rightarrow H_2CO + H_2O$ as catalyzed by MoO_3. We find that surface dioxo sites are critical to activating the methanol. Our conclusion is that an important catalytic site involves two adjacent surface dioxo units (the dual dioxo site), with each dioxo site extracting one H in a sequence of steps. The required dual dioxo site exists on the (010) surface of MoO_3 but does not exist on the other low index surfaces. This mechanism is supported by atmospheric pressure experimental studies which indicate that MoO_3(010) is selective for CH_2O products. A detailed sequence of reaction steps and the associated thermochemistry is proposed. 19 refs., 2 figs.

25892 Formation of D and H atoms in the pyrolysis of benzene-d_6 and chlorobenzene behind shock waves. Rao, V.S.; Skinner, G.B. (Wright State Univ., Dayton, OH). *Journal of Physical Chemistry;* **88**: No. 24, 5990-5995(22 Nov 1984). Contract AC02-76ER02944.

From the measurements of H atoms during pyrolysis of chlorobenzene under similar conditions at 1570-1790K, the first-order rate constant for the dissociation of chlorobenzene to chlorine atoms and phenyl radicals was found to be about an order of magnitude greater than that for the pyrolysis of C_6D_6, and a rate constant still another order of magnitude greater was noted for the dissociation of phenyl radicals to H atoms and other products. From this information, a rate constant was derived for the dissociation of benzene-d_6 to phenyl-d_5 and D atoms. The rate constant for the H-D exchange reaction on benzene was determined over the temperature range of 300-1400K by combining results of this work with that of others at lower temperatures. A very simple kinetic model based on a reaction chain with H as carrier can relate the data presented from this work to other shock-tube work at higher benzene concentrations.

25893 Pentahydridorhenium: crystal and molecular structure of $ReH_5(PMePh_2)_3$. Emge, T.J.; Koetzle, T.F.; Bruno, J.W.; Caulton, K.G. (Brookhaven National Lab., Upton, NY). *Inorganic Chemistry;* **23**: No. 24, 4012-4017(21 Nov 1984).

The crystal and molecular structure of the pentahydrido complex $ReH_5(PMePh_2)_3$, has been determined by x-ray diffraction techniques at room temperature and refined against neutron diffraction data obtained at 20 K to yield precise locations for all atoms. The two independent molecules in the unit cell possess essentially identical dodecahedral cores, with the three phosphines and one hydride in B (5-neighbor) positions and the remaining four hydrides in A (4-neighbor) sites. The mean Re-H bond distance is 1.688 (5)A, which is in agreement with that found in K_2ReH_9(1.68(1)A). At convergence with anisotropic thermal parameters refined for all 174 atoms (1568 variables), agreement factors are presented for 11,374 independent neutron observations. Crystal data at 20.0(5)K are presented for the complex. In solution, ^1H and ^{31}P (^1H) NMR meausrements indicated that the compounds are fluxional molecules, with magnetically equivalent hydrides and phosphides at 25°C.

25894 Ligand substitution reactions of a dinuclear platinum(I) complex. Shimura, M.; Espenson, J.H. (Iowa State Univ., Ames). *Inorganic Chemistry;* **23**: No. 24, 4069-4071(21 Nov 1984). Contract W-7405-ENG-82.

The complex $Pt_2Br_2(\mu\text{-dppm})_2$ when dppm = bis(diphenylphosphio)methane reacts with Et_4NCl in dichloromethane and dichloroethane to form $Pt_2Cl_2(\mu\text{-dppm})_2$. The reaction is reversible and proceeds via stepwise formation of the mixed-ligand (Br, Cl) complex. The reaction follows biphasic kinetics, and each step shows a linear dependence on [Et_4NCl], with rate constants 93 +/- 20 and 19.4 +/- 1.2 $M^{-1}\,s^{-1}$ for the respective steps (10.0°C in CH_2Cl_2). The identification of a rate constant with an individual step is a process that inherently admits of dual solutions; the assignment of values of h's was made on the basis that only this model gave a consistent and reasonable value for the molar absorptivity of the mixed-halide intermediate. The reaction in 1,2-dichloroethane shows a quite different kinetic pattern, with a single pseudo-first-order rate law and a more complex variation of the observed reaction constituent with [Et_4NCl].

25895 **X-ray photoelectron spectroscopic study of sulfur-nitrogen-fluorine compounds.** Beach, D.B.; Jolly, W.L.; Mews, R.; Waterfeld, A. (Univ. of California, Berkeley). *Inorganic Chemistry;* **23**: No. 24, 4080-4084(21 Nov 1984). Contract AC03-76SF00098.

The gas-phase core binding energies of NSF, NSF_3, and several compounds of the types NSF_2R and F_2SNR have been determined. Qualitative interpretation of the data shows that $N(p\pi) \rightarrow S(d\pi)$ bonding is probably important in the NSF_2R compounds and in NSF_3, that the bonding of the sulfur atom in NSF is similar to that in SO_2, and that the nitrogen atom of NSF_3 is more negatively charged than that of NSF (in spite of a stronger N-S bond in NSF_3). Quantitative interpretation of the data for NSF and NSF_3, together with literature valence ionization potentials, shows that the HOMO of each molecule has principally nitrogen 2p character and is stabilized by interaction with a higher lying sulfur 3d orbital. The approximate atomic orbital contributions to the other molecuar orbitals of these molecules are deduced.

4004 Electrochemistry

REFER ALSO TO CITATION(S) 25160, 25666, 25667, 25668

25896 **(LBL—18335) Electrochemistry of halogen electrodes in propylene carbonate.** Hanson, K.J. (Lawrence Berkeley Lab., CA (USA)). Dec 1984. Contract AC03-76SF00098. 230p. NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE85008452.

In this study, the electrochemical behavior of halogen/halide electrodes has been investigated. Included in this work are a study of the stability of propylene carbonate with respect to elemental chlorine, bromine, and iodine; an investigation of the solubility and conductivity of halogens and halide salts; and the determination of thermodynamic and kinetic characteristics of the iodide/triiodide/iodine couple. In the case of iodine, the equilibrium constant of the disproportionation reaction at 25°C was determined to be 0.85. Gas chromatography analysis showed that chlorine attacks even dried, distilled PC (less than 7 ppM water), and that the extent of the reaction increases with increasing water content of the solvent. However, solutions of iodine in PC are stable for several months. Conductivity experiments were performed to determine the extent of ion-pair formation of KI and KBr in PC. In addition, the conductivity of these solutions was measured as a function of the concentration of the corresponding halogen. Increased conductivity was noted for each solution, and a maximum was observed for equimolar iodide and iodine concentrations. Cyclic voltammograms of KI in supported ($KAsF_6$) propylene carbonate show two anodic peaks. To characterize the voltammograms, the following sequence of reactions is proposed: (1) $3I^- \rightarrow I_3^- + 2e^-$, and (2) $2I_3^- \rightarrow 3I_2 + 2e^-$. The validity of this mechanism was tested in an optically transparent thin layer cell by performing simultaneous cyclic voltammetry and uv-visible spectroscopy at a narrow mesh gold working electrode. The sequence of formation and disappearance of triiodide and iodine according to (1) and (2) was confirmed by the spectral scans repeated at 30 second intervals. A transport model for the simulation of the voltammograms was developed. The results indicate that reaction (1) is kinetically inhibited while reaction (2) is reversible.

4005 Photochemistry

REFER ALSO TO CITATION(S) 25444

4006 Radiation Chemistry

25897 (DOE/ER/60142—2, pp 93-122) **Stochastic treatment of fast chemical reactions.** Zaider, M.; Brenner, D.J. Jul 1984. NTIS, PC A18/MF A01. File Number DE84014885.

In Radiation physics, biophysics and radiation biology. Progress report, December 1, 1983-November 30, 1984.

Stochastic and deterministic treatments of radiochemical reaction kinetics in water are compared. Some Monte Carlo calculations for electron radiolysis of water are presented.

25898 (DOE/ER/60142—2, pp 82-92) **Transport of low energy electrons in water and some physico-chemical implications.** Brenner, D.J.; Zaider, M. Jul 1984. NTIS, PC A18/MF A01. File Number DE84014885.

In Radiation physics, biophysics and radiation biology. Progress report, December 1, 1983-November 30, 1984.

The possible indirect effect of low-energy electrons on cells through diffusing radicals from electron-water interactions is discussed. Some calculations on time-dependent yield of radical species from low-energy, sub excitation electron transport and thermalization are described.

25899 **Formation of excited states of N,N,N',N'-tetramethyl-p-phenylenediamine in irradiated nonpolar liquids.** Choi, H.T.; Tweeten, D.W.; Lipsky, S. (Univ. of Minnesota, Minneapolis). *Journal of Physical Chemistry;* **88**: No. 24, 5863-5867(22 Nov 1984).

The yield of N,N,N',N'-tetramethyl-p-phenylenediamine (TMPD) excited states, G/sub s/, has been obtained in irradiated tetramethylsilane, isooctane, cyclopentane, n-hexane, and cyclohexane as a function of TMPD concentration, c, over the range $c = 0.5 \times 10^{-3}$-50×10^{-3} M. In tetramethylsilane and isooctane, G/sub s/ is found to be linear on c as would be expected on the basis of a nondiffusional transfer of the solvent ion positive charge to TMPD followed by recombination of $TMPD^+$ with the geminate electron. In cyclopentane, n-hexane, and cyclohexane, G/sub s/ becomes increasingly concave downward in its depedence on c. This concavity is attributed to an increasing contribution to G/sub s/ from excited states of the solvent that nonradiatively transfer their energy to TMPD. Optical excitation of cyclohexane at 147 nm and measurement of the quenching of its fluorescence by TMPD confirm this view.

4007 Radiochemistry And Nuclear Chemistry

REFER ALSO TO CITATION(S) 25367, 25680, 25879

25900 **(CONF-8409209—2) Systematic view of transition intensities in the spectra of actinides and lanthanides in condensed phases.** Carnall, W.T.; Crosswhite, H.; Rajnak, K. (Argonne National Lab., IL (USA); Kalamazoo Coll., MI (USA). Dept. of Physics). 1985. Contract W-31-109-ENG-38. 32p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85010272.

From International symposium on rare earths spectroscopy; Wroclaw, Poland (10 Sep 1984).

The authors summarize the status of energy level and aquo ion transition intensity calculations for the trivalent lanthanides and actinides, and examine an apparent correlation between systematic changes in intensities and the crossover from delocalized to more localized f-electron behavior with increasing atomic number. 34 refs., 10 figs., 3 tabs.

25901 **(DP-MS—84-130) Determination of the association constant for pertechnetic acid.** Bibler, J.P.; Wallace, R.M. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1985. Contract AC09-76SR00001. 13p. (CONF-850417—17). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010224.

From 189. national meeting of the American Chemical Society; Miami, FL, USA (28 Apr 1985).

A novel method using distribution constants derived from equilibrium ion exchange experiments has been employed to determine a value, Ka, for the association quotient for pertechnetic acid. An average value of 0.416 for Kc, the quotient in terms of concentration, was determined in solutions of 1 to 6M total nitrate ion concentrations; the corresponding value for Ka in terms of activity was 1.16. Experimental data leading to this result are compiled in this document. 6 refs., 3 figs., 3 tabs.

25902 **(DP-MS—85-26) Historical review of californium-252 discovery and development.** Stoddard, D.H. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1985. Contract AC09-76SR00001. 14p. (CONF-850453—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010223.

From Workshop on neutron therapy: low dose rate and beam radiation therapy; Lexington, KY, USA (24 Apr 1985).

This paper discusses the discovery and history of californium 252. This isotope may be synthesized by irradiating plutonium 239, plutonium 242, americium 243, or curium 244 with neutrons in a nuclear reactor. Various experiments and inventions involving ^{252}Cf conducted at the Savannah River Plant are discussed. The evolution of radiotherapy using californium 252 is reviewed. (PLG)

25903 **(IPEN-Pub—54) Preparation of carrier-free ^{67}Ga, by irradiation of natural zinc with protons.** Fernandes, L.; Silva, C.P.G. da; Barbosa, M.F. de. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). Feb 1983. 13p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. File Number DE85700586.

A method for the preparation of carrier-free ^{67}Ga is described. Natural zinc plates were irradiated with protons. After a decay period of four days, the irradiated targets were dissolved in concentrated hydrochloric acid and the solution percolated through a glass column containing a cationic resin. ^{67}Ga was eluted with 3,5 N HCl; the eluted solution was evaporated to dryness, taken up in 3,8% sodium citrate solution and sterilized. Sterility tests were carried out according to the requirements of the U.S. Pharmacopeia. Chemical purity of ^{67}Ga citrate was determined by spot tests and by atomic absorption spectrophotometry. The radioactive purity was verified by gamma spectrometry. The product was endovenously injected into Wistar rats with experimental abcesses, and in a patient with adrenal neuroblastoma. The results shown a high accumulation of ^{67}Ga in soft tissue tumors.

25904 **Carbonate complexation of dioxoneptunium(VI) at 25°C: its effect on the Np(V)/Np(VI) potenial.** Maya, L. (Oak Ridge National Lab., TN). *Inorganic Chemistry;* 23: No. 24, 3926-3930(21 Nov 1984).

The carbonate complexation constants of dioxoneptunium(VI) were derived from potentiometric titrations of neptunium(VI) under different carbon dioxide partial pressures in the range between pH 5.0 and 8.0. The values obtained are similar to those of the dioxouranium(VI). The carbonate-containing species that attain a significant concentration in this pH range are monovalent monocarbonate trihydroxy dioxoneptunium(VI), divalent dicarbonate dioxoneptunium(VI), and quatravalent tricarbonate dioxoneptunium(VI) complexes. The constants of Np(VI) and those previously obtained for Np(V) were used to calculate potentials of the couple under conditions similar to those found in nature. It was found that Np(VI) can be stable in a natural environment between pH 7 and 10. However, this requires rather oxidizing conditions. Direct equilibrium potential measurements of the Np(V)/Np(VI) couple were made at the micromolar concentration range. These were used to assess the reliability of the complexation schemes of both oxidation states, and no gross departures were found.

4008 Combustion, Pyrolysis, And High-temperature Chemistry

REFER ALSO TO CITATION(S) 25478

25905 **(CONF-850578—2) Theoretical studies of combustion chemistry.** Harding, L.B.; Wagner, A.F.; Davis, M.J.; Eades, R.A.; Bair, R.A.; Dunning, T.H. Jr. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010284.

From DOE/BES contractors' combustion meeting; Lake Geneva, WI, USA (22 May 1985).

This paper discusses the mechanism of radical-radical reactions in flames. The reactions of atomic hydrogen with the formyl radical and atomic oxygen with acetylene are discussed as well as energy relaxation in carbonyl sulfide. 1 fig.

25906 **(DOE/ER/13170—1) Experimental determination of the mixing frequency parameter for coalescence/dispersion modeling of turbulent combustion. Annual progress report.** Butler, G.W. (Washington Univ., Seattle (USA). Dept. of Mechanical Engineering). 24 Sep 1984. Contract AT06-84ER13170. 20p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85011468.

The overall objective of this research is to experimentally determine the basic time scales of turbulent mixing in a high intensity combustion environment. The results of this research are directly applicable to the coalescence/dispersion (C/D) modeling technique of modeling turbulent combustion. In this technique the combustion field is divided into isolated, equal-mass elements (turbules) which, while continuously undergoing batch chemical reaction, interact (binary mixing) at a specified frequency, β. A basic hypothesis of this research is that β is related to the physics of the system being modeled and, as with a chemical reaction mechanism, can be characterized by a single, slowest mixing time scale. The specific objectives of this research are therefore: (1) measurement of the characteristic fluid-mixing frequency for a practical range of fuel-air equivalence ratios, (2) comparison of the experimental data with existing analytical and numerical models for combustor mixing frequencies which are derived from global fluid mechanical arguments, and (3) interpretation of the measurements of the mixing frequency, β, in order to model its dependence on the physical parameters of the combustion process. Technical efforts during this contract time period have focused on three parallel tasks: development of the Rayleigh scattering diagnostic system, and the tracer gas injection and measurement technique; the vectorization of appropriate statistical algorithms for data reduction and analysis; and study of the C/D theoretical basis and application of numerical simulation to previous experiments published in the literature. 6 figs.

25907 **(NASA-TM—85746) Model for reaction rates in turbulent reacting flows.** Chinitz, W.; Evans, J.S. (Cooper Union, New York (USA); National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center). May 1984. 44p. NTIS, PC A03/MF A01. File Number TI85901298.

To account for the turbulent temperature and species-concentration fluctuations, a model is presented on the effects of chemical reaction rates in computer analyses of turbulent reacting flows. The model results in two parameters which multiply the terms in the reaction-rate equations. For these two parameters, graphs are presented as functions of the mean values and intensity of the turbulent fluctuations of the temperature and species concentrations. These graphs will facilitate incorporation of the model into existing computer programs which describe turbulent reacting flows. When the model was used in a two-dimensional parabolic-flow computer code to predict the behavior of an experimental, supersonic hydrogen jet burning in air, some improvement in agreement with the experimental data was obtained in the far field in the region near the jet centerline. Recommendations are included for further improvement of the model and for additional comparisons with experimental data.

25908 **(RFP—3745) Binary phase diagram determinations.** Oetting, F.L.; Martins, G.P.; Smith, C.M. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 28 Mar 1985. Contract AC04-76DP03533. 17p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010856.

The potassium chloride-calcium chloride binary phase diagram was generated from both the theoretical and experimental approach in this laboratory. The theoretical technique was based on a computer evaluation of the excess free energies of the components, and the experimental approach utilized the data obtained by differential thermal analysis (DTA) on the salts composing this binary system. The results obtained by these two techniques are in good agreement with the KCl-$CaCl_2$ phase diagram given in the literature. 12 refs., 8 figs., 2 tabs.

42 ENGINEERING

REFER ALSO TO CITATION(S) 25815

4201 General Engineering

25909 (SAND—84-8018) Using synchro-ballistic cameras to determine the velocity and spin rate of high-velocity projectiles. Abrahams, D.M. (Sandia National Labs., Livermore, CA (USA)). Apr 1985. Contract AC04-76DR00789. 20p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010829.

For many years, Sandia Laboratories has been test firing 155-mm and eight-inch projectiles from guns at the Tonopah Test Range in Nevada. In addition to telemetry data, the projectile velocity is required and, for 155-mm projectiles, the spin rate near the muzzle exit as well. These data are gathered photographically by using two pairs of 35-mm streaking cameras in the synchro-ballistic mode. For backup, velocity is also measured with a Doppler radar system. Because the guns are fired at a nearly vertical elevation, the cameras are mounted on a tower so that their viewpoint is above the muzzle blast. Films from these cameras are processed at the Tonopah Test Range and returned to the Photometrics Division at Sandia's Livermore Laboratory for printing and data analysis. This report discusses the camera equipment and in particular how it is used to obtain velocity and spin data for 155-mm projectiles. 8 figs.

25910 (SAND—85-0515) SANDRAG: a computer code for predicting drag of bodies of revolution at zero angle of attack in incompressible flow. Wolfe, W.P.; Oberkampf, W.L. (Sandia National Labs., Albuquerque, NM (USA)). Apr 1985. Contract AC04-76DP00789. 78p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85011170.

A design method is presented for calculating the flow field and drag of bodies of revolution at zero angle of attack in compressible flow. The body pressure distribution, viscous shear stress, and boundary layer separation point are calculated by a combination of a potential flow method and boundary layer techniques. The potential solution is obtained by modeling the body with an axial distribution of source/sink elements whose strengths vary linearly along their length. Both the laminar and turbulent boundary layer solutions use momentum integral techniques which have been modified to account for the effects of surface roughness. An existing technique for estimating the location of transition was also modified to include surface roughness. Empirical correlations are developed to estimate the base pressure coefficient on a wide variety of geometries. Body surface pressure distributions and drag predictions are compared with experimental data for artillery projectiles, conical, and flared bodies. Very good agreement between the present method and experiment is obtained. 30 refs., 31 figs., 6 tabs.

25911 (UCRL—91619) Decentralized control synthesis method for large-scale interconnected systems. Young, K.D. (Lawrence Livermore National Lab., CA (USA)). 2 Oct 1984. Contract W-7405-ENG-48. 16p. (CONF-850622—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000748.

From American Control conference; Boston, MA, USA (19 Jun 1985).

A decentralized control synthesis method which is developed using a concept of interconnection rejection is proposed herein. Sufficient conditions under which this type of decentralized controllers can be synthesized are given.

25912 (Y/DX—631) Quality control in a deterministic manufacturing environment. Barkman, W.E.; Babelay, E.F.; De Mint, P.D.; Lewis, J.C.; Woodard, L.M. (Oak Ridge Y-12 Plant, TN (USA)). 24 Jan 1985. Contract AC05-84OS21400. 10p. (CONF-8504104—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010047.

From Meeting of the Society of Manufacturing Engineers (CIMCOM '85); Anaheim, CA, USA (16 Apr 1985).

An approach for establishing quality control in processes which exhibit undesired continual or intermittent excursions in key process parameters is discussed. The method is called deterministic manufacturing, and it is designed to employ automatic monitoring of the key process variables for process certification, but utilizes only sample certification of the process output to verify the validity of the measurement process. The system utilizes a local minicomputer to sample the appropriate process parameters that describe the condition of the machine tool, the cutting process, and the computer numerical control system. Sampled data are pre-processed by the minicomputer and then sent to a host computer that maintains a permanent data base describing the manufacturing conditions for each work piece. Parts are accepted if the various parameters remain within the required limits during the machining cycle. The need for additional actions is flagged if limits are exceeded. With this system it is possible to retrospectively examine the process status just prior to the occurrence of a problem. (LEW)

4202 Facilities And Equipment

REFER ALSO TO CITATION(S) 25294, 25760, 25949, 26420

25913 (AD-A—150010/7/XAB) Thin film technology of high-critical-temperature superconducting electronics. Annual report, 1 November 1983-31 October 1984. Talvacchio, J.; Braginski, A.I.; Janocko, M.A. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center). 1 Dec 1984. 63p. NTIS, PC A04/MF A01.

During the second year of performance under this program, the atomic segregation on A15 surfaces was evaluated and resulted in Nb_3Sn replacing V_3Si as the tunnel junction this program, the atomic segregation on A15 surfaces was evaluated and resulted in Nb3Sn replacing V3Si as the tunnel junction high-T/sub c/ base electrode. A process of all-refractory test junction patterning by wet and/or reactive ion etching was implemented. Epitaxial, textured tunnel-barrier structures of the form Al/Al_2O_3, Y/Y_2O_3, and $Al/Al_2O_3/Al$, were fabricated. Tunnel junctions with Nb, Nb_3Sn, and Mo-Re base and Pb-Bi counterelectrodes have been formed with the barrier structures and had excellent I-V characteristics. Junctions with Nb counterelectrodes exhibited high subgap leakage currents. The Mo(65)Re(35) alloy was found to be an ideal material for counterelectrodes having T/sub c/=12K.

25914 (CONF-8506106—1) HERMIES-I: a mobile robot for navigation and manipulation experiments. Weisbin, C.R.; Barhen, J.; de Saussure, G.; Hamel, W.R.; Jorgensen, C.; Lucius, J.L.; Oblow, E.M.; Swift, T. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 18p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85008652.

From Robots 9 conference; Detroit, MI, USA (2 Jun 1985).

The purpose of this paper is to report the current status of investigations ongoing at the Center for Engineering Systems Advanced Research (CESAR) in the areas of navigation and manipulation in unstructured environments. The HERMIES-I mobile robot, a prototype of a series which contains many of the major features needed for remote work in hazardous environments is discussed. Initial experimental work at CESAR has begun in the area of navigation. It briefly reviews some of the ongoing research in autonomous navigation and describes initial research with HERMIES-I and associated graphic simulation. Since the HERMIES robots will generally be composed of a variety of asynchronously controlled hardware components (such as manipulator arms, digital image sensors, sonars, etc.) it seems appropriate to consider future development of the HERMIES brain as a hypercube ensemble machine with concurrent computation and associated message passing. The basic properties of such a hypercube architecture are presented. Decision-making under uncertainty eventually permeates all of our work. Following a survey of existing analytical approaches, it was decided that a stronger theoretical basis is required. As such, this paper presents the framework for a recently developed hybrid uncertainty theory. 21 refs., 2 figs.

25915 (DOE/AL/27864—T1) Market survey to assess the procurement of (2) Keensert: mechanical devices inserted into base material to accept threaded bolts without metal galling. Volume II. (Engineering Analysis and Test Co., Santa Monica, CA (USA)). 29 Apr 1985. Contract AC04-84AL27864. 48p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85011374.

This document presents the results of a study performed to assess the precurement of threaded inserts (e.g., Keenserts) for use on the DHLW Truck Cask.

25916 (DOE/ER/02890—T2) Flux pinning and flux flow studies in superconductors using flux flow noise techniques. Final technical report, April 1, 1977-March 31, 1984. Joiner, W.C.H. (Cincinnati Univ., OH (USA)). Mar 1985. Contract AC02-76ER02890. 196p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE85010814.

Flux flow and flux pinning have been studied in several alloys characterized by a variety of shapes of volume pinning force curves. Annealing is used to modify these curves and to study the accompanying changes in the flux flow noise. A model of flux motion interrupted by local pinning interactions is presented. This model provides excellent fits to experimental flux flow noise spectra as well as to experimental current-voltage characteristics. Noise spectra are shown to be extremely sensitive probes of changes in pinning. Noise results and volume pinning force curves are explained qualitatively, and in some cases quantitatively by a model developed by Kramer, modified by the corrected expression for the elastic shear constant as calculated by Brandt. Models based on the ideas of Larkin and Ovchinnikov do not seem to apply to the field dependence of our experimental noise results. Other features studied include flux flow hysteresis and transient effects. A model is presented which is in good agreement with observations on transients.

25917 (DP—226) Critical configurations of enriched uranium-aluminum alloy in light water. Mortenson, J.H. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Jul 1957. Contract AC09-76SR00001. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85008061.

Material buckling and multiplication measurements were taken for lattices of tubes of enriched uranium-aluminum alloy in light water. Different tube sizes were used at a variety of tube spacings to cover a range of fuel-to-moderator ratios from 20 to 90 grams of U-235 per liter of H_2O. The effects of voids and poisons in the lattices were also determined. The results are applicable both for specifying safe methods of handling the tubes to prevent unwanted criticality and for the design of critical assemblies.

25918 (LBL—18704) Microstructural state of Nb_3Sn in a multifilamentary titanium doped bronze-process wire. Johnson-Walls, P.E.; Tribula, D.; Dietderich, D.R.; Hassenzahl, W.V.; Morris, J.W. Jr. (Lawrence Berkeley Lab., CA (USA)). Sep 1984. Contract AC03-76SF00098. 10p. (CONF-840937—30). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010979.

From Applied superconductivity conference; San Diego, CA, USA (9 Sep 1984).

The addition of titanium to bronze-processed Nb_3Sn wires is known to increase the upper critical field and, thus, improve the high field performance. High resolution studies were done to determine the effect, if any, on the microstructure caused by Ti addition. This work used a Hitachi wire with a Nb filament diameter of 3.5 μm and a bronze to niobium ratio of 2.5. The bronze matrix had 7.5 at. % Sn and 0.4 at. % Ti. The microstructure of the Nb_3Sn layer was studied in TEM on axial and longitudinal wire sections and in SEM on fractured wire surfaces. The results were compared with a previous study on a similarly processed Ti-free wire. It was found that the Ti addition caused no qualitative change in the microstructure. This result is contrasted with previous work on the beneficial effect of Mg additions that have been shown to be predominantly microstructural.

25919 (LBL—19004) Computer studies of the quench behavior of an SSC model-dipole. Moritz, G.; Hassenzahl, W. (Lawrence Berkeley Lab., CA (USA)). Mar 1985. Contract AC03-76SF00098. 22p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010633.

In the absence of experimental data on the magnets themselves, an attempt is made to estimate the characteristics of quenches, particularly the hot spot temperature, in the SSC Reference Design A dipoles. The quenches are analyzed using the computer program QUENCH. Input data, material characteristics, are similar to those for other accelerator dipoles. Preliminary calculations show that the magnets could be self-protecting and that a heater may not be necessary, depending on the conductor used. (LEW)

25920 (LBL—19013) Overview of applications of SQUIDs. Clarke, J. (Lawrence Berkeley Lab., CA (USA)). Nov 1984. Contract AC03-76SF00098. 8p. (CONF-8411161—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85009942.

From SQUID magnetometry workshop; Berkeley Springs, WV, USA (12 Nov 1984).

Those factors that limit the performance of SQUIDs are briefly discussed, including white noise, flicker (1/f) noise, drift, factors determined by the electronics used to flux-lock the SQUID (including frequency response, slew rate, and dynamic range), and environmental electromagnetic noise. (LEW)

25921 (MLM—3237(OP)) DOT Specification 7A Type A packaging certification study: getting ready for July 1, 1985. Edling, D.A. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 1985. Contract AC04-76DP00053. 4p. (CONF-850314—60). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010808.

From Waste management '85; Tucson, AZ, USA (24 Mar 1985).

The Department of Energy has funded Mound to revise the Type A Packaging Certification Study originally issued in June 1975. An updated document is necessary because, effective July 1, 1985, 49 CFR 173.412(b) requires that any Spec. 7A packaging designed, manufactured, or certified after that date must be certified according to the Type A packaging test given in 173.465. As a result, shippers of Spec. 7A packagings must test and analyze their packaging and prepare a certification document before July 1985 in order to continue uninterrupted operation. (It should be noted that existing Spec. 7A packages manufactured and certified prior to July 1, 1985, may be used as long as the packagings continue to meet the Spec. 7A requirements. However, a Type A packaging designed, manufactured, or certified after July 1, 1985, must meet the requirements of 49 CFR effective on July 1, 1985.) Mound will identify those Type A packagings commonly used by DOE contractors and will begin a testing and analysis program to determine which packagings meet the new Type A requirement. Those packagings certified as DOE Spec. 7A Type A packagings will be featured in a document for all of DOE to use. 5 tabs.

25922 (SAND—84-1899C) Three-dimensional finite element impact analysis of a nuclear waste truck cask. Miller, J.D. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 11p. (CONF-850670—15). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010653.

From ASME pressure vessel and piping division conference; New Orleans, LA, USA (24 Jun 1985).

This paper presents a three-dimensional finite element impact analysis of a hypothetical accident event for the preliminary design of a shipping cask which is used to transport radioactive waste by standard tractor-semitrailer truck. The nonlinear dynamic structural analysis code DYNA3D run on Sandia's Cray-1 computer was used to calculate the effects of the cask's closure-end impacting a rigid frictionless surface on an edge of its external impact limiter after a 30-foot fall. The center of gravity of the cask (made of 304 stainless steel and depleted uranium) was assumed to be directly above the impact point. An elastic-plastic material constitutive model was used to calculate the nonlinear response of the cask components to the transient loading. Interactive color graphics (PATRAN and

MOVIE BYU) were used throughout the analysis, proving to be extremely helpful for generation and verification of the geometry and boundary conditions of the finite element model and for interpretation of the analysis results. Results from the calculations show the cask sustained large localized deformations. However, these were almost entirely confined to the impact limiters built into the cask. The closure sections were determined to remain intact, and leakage would not be expected after the event. As an example of a large three-dimensional finite element dynamic impact calculation, this analysis can serve as an excellent benchmark for computer aided design procedures.

25923 **(SAND—84-2562) Touch-off: a method to determine the position of an object by means of a sensor-driven robot.** Hamilton, P.S.; Starr, G.P. (Sandia National Labs., Albuquerque, NM (USA)). Jan 1985. Contract AC04-76DP00789. 72p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85011178.

Touch-off is a method used by a force sensor-driven robot to accurately determine a reference frame on an object when only the approximate location of the object is known. It yields a precise and repeatable definition of the location of the object relative to the base coordinate frame of the robot. Once this reference frame has been defined, all robot locations can be specified relative to this object frame. If the object is subsequently moved, one needs only to redefine the object frame by using the Touch-off procedure. The calculations necessary for the procedure are presented along with the results of the experimental verification. Although developed for use in performing maintenance of the Sandia Pulsed Reactor (SPR III), the Touch-off procedure is applicable to a wide range of object location and orientation tasks.

25924 **(UCRL—89362) Motion control system for the Large Optic Diamond Turning Machine (LODTM).** McCue, H.K. (Lawrence Livermore National Lab., CA (USA)). 1983. Contract W-7405-ENG-48. 9p. (CONF-830874—33). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005515.

From 27. annual technical symposium of the Society of Photo-Optical Instrumentation Engineers (SPIE); San Diego, CA, USA (21 Aug 1983).

LODTM, built by LLNL for DOD, is a precision vertical lathe used to diamond turn large optical parts (to 64" diameter) to 1 μinch rms figure error. The LODTM motion controls require precision sensors, precision servos, and a wideband (330 Hz) real time computer. Position is sensed to 1/40 μinch resolution by laser interferometers and differential capacitance gauges. Presision servos operating at 1/10 μinch resolution and at low velocities with zero backlash are required. A unique Fast Tool Servo (FTS), located close to the diamond tool, adjusts the final tool position. The LODTM controls coordinate the X, Z and FTS servos to cause the tool to move on a specified contour and at a specified feedrate in the X-Z plane. The part floppy diskette commands this motion with a linear CNC and real time (32-bit) computer. During each 1.5 ms sample time, the computer must DMA 14 sensor readings into memory, calculate the X and Z Tool Coordinates, calculate the FTS input, output the following errors, output the FTS input, store "flight recorder" information, and check for anomalies.

25925 **Heat conduction in heterogeneous materials.** Baker-Jarvis, J.; Inguva, R. (Department of Physics and Astronomy, University of Wyoming, Laramie, Wyoming 82071). *Journal of Heat Transfer;* **107**: No. 1, 39-98(Feb 1985). Contract AS20-81LC10783.

A new solution to the heat equation in composite media is derived using a variational principle developed by Ben-Amoz. The model microstructure is fed into the equations via a term for the polar moment of the inclusions in a representative volume. The general solution is presented as an integral in terms of sources and a Green function. The problem of uniqueness is studied determine appropriate boundary conditions. The solution reduces to the solution of the normal heat equation in the limit of homogeneous media.

25926 **Gas pump with movable gas pumping panels.** Osher, J.E. (to Dept. of Energy). US Patent 4,479,361. 30 Oct 1984. Filed date 2 Mar 1983. vp. PAT-APPL-471391.

Apparatus for pumping gas continuously consists of a plurality of articulated panels of getter material, each of which absorbs gases on one side while another of its sides is simultaneously reactivated in a zone isolated by the panels themselves from a working space being pumped.

25927 **Beam current sensor.** Kuchnir, M.; Mills, F.E. (to Dept. of Energy). US Patent Application 6-655,487. 28 Sep 1984. 24p. Contract AC02-76CH03000.

A current sensor for measuring the dc component of a beam of charged particles employs a superconducting pick-up loop probe, with twisted superconducting leads in combination with a Superconducting Quantum Interference Device (SQUID) detector. The pick-up probe is in the form of a single-turn loop, or a cylindrical toroid, through which the beam is directed and within which a first magnetic flux is excluded by the Meisner effect. The SQUID detector acts as a flux-to-voltage converter in providing a current to the pick-up loop so as to establish a second magnetic flux within the electrode which nulls out the first magnetic flux. A feedback voltage within the SQUID detector represents the beam current of the particles which transit the pick-up loop. Meisner effect currents prevent changes in the magnetic field within the toroidal pick-up loop and produce a current signal independent of the beam's cross-section and its position within the toroid, while the combination of superconducting elements provides current measurement sensitivities in the nano-ampere range.

25928 **Evaluation of irritant smoke qualitative fitting test for respirators.** Marsh, J.L. (Los Alamos National Lab., NM). *American Industrial Hygiene Association Journal;* **45**: No. 4, 245-249(Apr 1984).

The results of a qualitative fit test, utilizing an irritant smoke, were compared to the results of a quantitative fit test, utilizing an oil mist aerosol, for both half-mask and full facepiece respirators. For a respirator wearer combination having a fit factor less than 10, as determined by the quantitative test, the point estimate of the probability of that combination's not being rejected by the irritant smoke qualitative test was found to be 0.00 with 95% confidence that this statistic will not exceed 0.08. For a respirator wearer combination having a fit factor less than 100, the point estimate of the probability of that combination's not being rejected by the qualitative test was found to be 0.04 with 95% confidence that this statistic will not exceed 0.08. The point estimate of the probability of rejecting a fit factor greater than or equal to 10 was found to be 0.58, with 95% confidence that this statistic will not exceed 0.65. The point estimate of the probability of rejecting a fit factor greater than or equal to 100 was found to be 0.30, with 95% confidence that this statistic will not exceed 0.39.

25929 **Workpiece fixturing for precision machining.** Barkman, W.E. (Union Carbide Corp., Oak Ridge, TN). *Precision Engineering;* **4**: No. 2, 101-105(Apr 1982). Contract W-7405-ENG-26.

To keep within the tolerances required in precision machining workpiece fixturing has to ensure minimal distortion of the part. Some of the methods used at the Oak Ridge Y-12 Plant are reviewed. Significant factors are discussed and three-point mounting, vacuum fixturing and potting are described.

4203 Lasers

REFER ALSO TO CITATION(S) 25988, 25991, 25996, 25997

25930 **(AD-A—149682/7/XAB) Investigation of plasma processes in electronic-transition lasers. Annual report, 1 January-31 December 1984.** Nighan, W.L. (United Technologies Research Center, East Hartford, CT (USA)). 15 Dec 1984. 36p. (UTRC/R—84-922617-1). NTIS, PC A03/MF A01.

United Technologies Research Center is conducting a theoretical investigation of the fundamental processes affecting the operation, performance and application of electrically excited lasers having potential utility in a variety of areas of importance to the Navy. Particular attention is presently focused on the broadband

xenon fluoride (C yields A) laser, which has the potential for efficient, tunable operation throughout the blue-green spectral region. The research at UTRC is closely coordinated with a complementary ONR-supported experimental program being conducted at Rice University. This report summarizes recent results of this investigation, and includes reprints of recently published papers in which specific results and conclusions of the research are described in detail.

25931 **(AD-A—149686/8/XAB) Betatron-synchrotron detrapping in a tapered-wiggler free-electron laser. Memorandum report, June 1979-November 1984.** Sprangle, P.; Tang, C.M. (Naval Research Lab., Washington, DC (USA)). 31 Dec 1984. 15p. (NRL-MR—5445). NTIS, PC A02/MF A01.

Betatron-synchrotron resonance detrapping is shown to take place when the wiggler magnetic field amplitude is tapered. This resonance exists even if the radiation wavefronts are not curved and is only dependent on the transverse gradient of the tapered wiggler field.

25932 **(AD-A—149688/4/XAB) Dynamics of space-charge waves in the laser beat-wave accelerator. Memorandum report.** Tang, C.M.; Sprangle, P.; Sudan, R.N. (Naval Research Lab., Washington, DC (USA)). 30 Jan 1985. 50p. (NRL-MR—5324). NTIS, PC A03/MF A01.

The excitation of plasma waves by two laser beams, whose frequency difference is approximately the plasma frequency, is analyzed. This nonlinear analysis is fully relativistic in the axial and transverse directions and includes mismatching of the laser beat frequency to the plasma frequency, time-dependent laser amplitudes, and an applied transverse magnetic field (surfatron configuration). The analytical results for the large-amplitude plasma waves includes an axial constant of motion, accelerating electric field, and its phase velocity. The analytical results in the weak laser power limit are in good agreement with numerical results obtained from the complete equations. The imposed transverse magnetic field is found to increase the effective plasma frequency, but has little effect on the plasma dynamics.

25933 **(AD-A—149779/1/XAB) 50-kw electric-discharge CO_2 laser.** Whitcher, R.E.; McLeary, R. (Materials Research Labs., Maribyrnong (Australia)). Jul 1984. 20p. (MRL-R—933). NTIS, PC A02/MF A01.

This report describes an electric-discharge carbon dioxide mixing laser which has been designed and constructed at MRL. The laser, which utilizes a plasma-injection stabilized discharge in atmospheric-pressure nitrogen, delivers an output power of 50 kW for reservoir-limited durations of 3 seconds at an overall efficiency of 7%.

25934 **(AD-A—150059/4/XAB) Resonance between betatron and synchrotron oscillations in a free electron laser: a 3-d numerical study. Memorandum report.** Tang, C.M.; Sprangle, P. (Naval Research Lab., Washington, DC (USA)). 30 Jan 1985. 21p. (NRL-MR—5499). NTIS, PC A02/MF A01.

The effect of betatron and synchrotron resonance on the gain process of the free electron laser (FEL) is analyzed, including betatron oscillations, finite beam emittance, self-consistent electron dynamics, and a 3-D radiation field. Betatron oscillations force the electrons to be affected by an oscillatory radiation amplitude and phase in a Gaussian resonator radiation field. We show that not only can the radiation phase variation cause a resonance between approximately twice the betatron wavenumber and the synchrotron wavenumber, but the radiation amplitude variation in an FEL with efficiency enhancement schemes or just a tapered magnetic wiggler field amplitude Bw can also have a similar resonance effect. Numerical results for a 10-micrometer FEL are given. It is found that, for short wigglers, the effect of the betatron-synchrotron instability on the gain is negligible for Gaussian electron beams with radius less than 0.8 times the radiation-beam spot size.

25935 **(AD-A—150094/1/XAB) Exploration of new methods to produce efficient sources of coherent near-millimeter wave radiation. Final report, November 1982-May 1984.** Feld, M.S.; Dasari, R.R.; Thomas, J.E. (Massachusetts Inst. of Tech., Cambridge (USA). George R. Harrison Spectroscopy Lab.). 16 Nov 1984. 20p. NTIS, PC A02/MF A01.

A summary is presented of a feasibility study for a new concept, photon recycling, which was proposed as a new means of generating near-millimeter wave radiation using gas-dynamic cooling. A general theoretical analysis of this concept is presented which shows that small partition fractions and low temperatures lead to an unwieldly geometry for the nozzle design.

25936 **(AD-A—150451/3/XAB) Chemical stabilization of laser dyes. Final report, 1 July 1981-1 October 1984.** Koch, T.H. (Colorado Univ., Boulder (USA). Dept. of Chemistry). Nov 1984. 7p. NTIS, PC A02/MF A01.

Coumarin laser dyes upon excitation degrade to produce products which absorb at the lasing wavelength. This results in attenuation of dye laser output. Modes of degradation of coumarin dye lasers under both anaerobic and aerobic conditions were determined and methods of stabilization of dye lasers were established.

25937 **(LA-UR—85-1216) Grazing incidence beam expander.** Akkapeddi, P.R.; Glenn, P.; Fuschetto, A.; Appert, Q.; Viswanathan, V.K. (Perkin-Elmer, Danbury, CT (USA); Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 11p. (CONF-850345—22). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010784.

From Southwest conference on optics; Albuquerque, NM, USA (4 Mar 1985).

A Grazing Incidence Beam Expander (GIBE) telescope is being designed and fabricated to be used as an equivalent end mirror in a long laser resonator cavity. The design requirements for this GIBE flow down from a generic Free Electron Laser (FEL) resonator. The nature of the FEL gain volume (a thin, pencil-like, on-axis region) dictates that the output beam be very small. Such a thin beam with the high power levels characteristic of FELs would have to travel perhaps hundreds of meters or more before expanding enough to allow reflection from cooled mirrors. A GIBE, on the other hand, would allow placing these optics closer to the gain region and thus reduces the cavity lengths substantially. Results are presented relating to optical and mechanical design, alignment sensitivity analysis, radius of curvature analysis, laser cavity stability analysis of a linear stable concentric laser cavity with a GIBE. Fabrication details of the GIBE are also given.

25938 **(LA-UR—85-1288) E-beam-induced fluorescence of excimers in cryogenic solutions.** Loree, T.R.; Showalter, R.R.; Johnson, T.M.; Telle, J.M.; Fisher, R.A.; Hughes, W.M. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 12p. (CONF-850345—20). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010703.

From Southwest conference on optics; Albuquerque, NM, USA (4 Mar 1985).

We have detected the fluorescence emitted from excimer molecules formed in e-beam-pumped mixtures in a liquid argon host. The mixtures were both binary (halogen donors in the liquid argon) and ternary (dilute concentrations of donors and other rare gases in the liquid argon). Many excimers were observed, including the rare-gas dimers Xe_2, Kr_2, and Ar_2. Strong fluorescence was seen from XeF, XeCl, and ArO.

25939 **Experimental study of millimeter wave radiation from a rotating electron beam in a rippled magnetic field.** Destler, W.W.; Aghamir, F.M.; Boyd, D.A.; Bekefi, G.; Shefer, R.E.; Yin, Y.Z. (University of Maryland, College Park, Maryland 20742). *Physics of Fluids;* **28**: No. 6, 1962-1967(Jun 1985).

The generation of millimeter wave radiation from the interaction of a rotating electron beam (2 MeV, 1 kA, 5 nsec) with an azimuthally periodic wiggler magnetic field has been studied experimentally. Calculations of the effects of the wiggler magnetic field on the single particle electron orbits are presented, together with experimental measurements of the effects of the wiggler field

on the electron beam. Narrow-band radiation at power levels in excess of 200 kW has been observed at 88 and 175 GHz for wiggler fields with 6.28 and 3.14 cm periods, respectively. The radiation frequency spectra for various experimental configurations are presented, and results are compared with theoretical expectations.

25940 **Free electron laser using RF coupled accelerating and decelerating structures.** Brau, C.A.; Boyd, T.J. Jr.; Swenson, D.A. (to Dept. of Energy). US Patent 4,479,218. 23 Oct 1981. Filed date 19 Jun 1981. vp.

PAT-APPL-275478.

A free electron laser and free electron laser amplifier using beam transport devices for guiding an electron beam to a wiggler of a free electron laser and returning the electron beam to decelerating cavities disposed adjacent to the accelerating cavities of the free electron laser. Rf energy is generated from the energy depleted electron beam after it emerges from the wiggler by means of the decelerating cavities which are closely coupled to the accelerating cavities, or by means of a second bore within a single set of cavities. Rf energy generated from the decelerated electron beam is used to supplement energy provided by an external source, such as a klystron, to thereby enhance overall efficiency of the system.

4204 Heat Transfer And Fluid Flow

REFER ALSO TO CITATION(S) 25137, 25532, 25589

25941 **(AD-A—149849/2/XAB) Two-dimensional measurements of OH concentration and temperature in reactive flows. Final report, July 1981-March 1984.** Dyer, M.J.; Crosley, D.R. (SRI International, Menlo Park, CA (USA)). 5 Dec 1984. 39p. NTIS, PC A03/MF A01.

This report describes two related efforts that have as a common objective the development of new aspects of laser-induced fluorescence for measurements in time-varying reactive flows such as turbulent flames. The first effort was the demonstration, development and study of two-dimensional fluorescence imaging in flames. This provides a spatially correlated map of the concentration of OH radicals from a single laser shot. The second effort was the development of vibrational transfer thermometry, in which upward collisional energy transfer in the A2+ state of laser excited OH in flames is used to measure temperature simultaneously with OH concentration. Although a good correlation (better than 5 per cent rms deviation) between measured intensities and temperature was obtained in the range 1400-2700K, it has not been possible thus far to place the method on a sound fundamental, theoretical footing.

25942 **Instability of long fingers in Hele—Shaw flows.** Park, C.W.; Homsy, G.M. (Department of Chemical Engineering, Stanford University, Stanford, California 94305). *Physics of Fluids;* **28**: No. 6, 1583-1585(Jun 1985).

Experiments on steady fingers and their stability in Hele—Shaw cells, are reported. It is shown that the shape of steady fingers scales with a modified capillary number, Ca′, as suggested by McLean and Saffman [J. Fluid. Mech. 102, 455 (1981) and our previous analysis [J. Fluid Mech. 139, 291 (1984)]. The behavior at large Ca′ is investigated by using a wide Hele—Shaw cell. It is observed that such fingers are unstable for Ca′>100, in agreement with the prediction by Taylor and Saffman (second symposium on naval hydrodynamics, 1958, p. 277) of instability as Ca′→∞. The mechanism is identified as one of tip-splitting, which occurs periodically in the weakly supercritical regime, and in a more complex fashion for large Ca′.

25943 **Experimental, variable properties natural convection from a large, vertical, flat surface.** Siebers, D.L.; Moffatt, R.F.; Schwind, R.G. (Sandia National Laboratories, Livermore, Calfornia). *Journal of Heat Transfer;* **107**: No. 1, 124-167(Feb 1985). Contract AC04-76DP00789.

Natural convection heat transfer from a vertical 3.02 m high by 2.95 m long, electrically heat surface in air was studied. The air was at the ambient temperature and the atmospheric pressure, and the surface temperature was varied from 60C to 520 C. These conditions resulted in Grashof numbers up to 2 x 10^{12} and surface-to-ambient temperature ratios up to 2.7. Convective heat transfer coefficients were measured at 105 locations on the surface by an energy balance. Boundary layer mean temperature profiles were measured with a thermocouple. Results show that: (1) the turbulent natural convection heat transfer data are correlated by the expression a a Nu/sub y/ = 0.098Gr/sub y//sup 1/3/(T/sub w//T/sub infinity/)/sup -0.14/ =(when all properties are evaluated at =(T-italic/sub infinity/; (2) variable properties do not have a significant effect on laminar natural convection heat transfer; (3) the transition Grashof number decreases with increasing temperature; and (4) the boundary layer mean temperature profiles for turbulent natural convection can be represented by a "universal" temperature profile.

25944 **Selective radiative cooling with MgO and/or LiF layers.** Berdahl, P.H. (to Dept. of Energy). US Patent Application 6-650,593. 14 Sep 1984. 16p. Contract AC03-76SF00098.

A selective radiation cooling material which is absorptive only in the 8 to 13 microns wavelength range is accomplished by placing ceramic magnesium oxide and/or polycrystalline lithium fluoride on an infrared-reflective substrate. The reflecting substrate may be a metallic coating, foil or sheet, such as aluminum, which reflects all atmospheric radiation from 0.3 to 8 microns, the magnesium oxide and lithium fluoride being nonabsorptive at those wavelengths. <10% of submicron voids in the material is permissible in which case the MgO and/or LiF layer is diffusely scattering, but still nonabsorbing, in the wavelength range of 0.3 to 8 microns. At wavelengths from 8 to 13 microns, the magnesium oxide and lithium fluoride radiate power through the "window" in the atmosphere, and thus remove heat from the reflecting sheet of material and the attached object to be cooled. At wavelengths longer than 13 microns, the magnesium oxide and lithium fluoride reflects the atmospheric radiation back into the atmosphere. This high reflectance is only obtained if the surface is sufficiently smooth: roughness on a scale of 1 micron is permissible but roughness on a scale of 10 microns is not. An infrared-transmitting cover or shield is mounted in spaced relationship to the material to reduce convective heat transfer. If this is utilized in direct sunlight, the infrared transmitting cover or shield should be opaque in the solar spectrum of 0.3 to 3 microns.

4205 Materials Testing

REFER ALSO TO CITATION(S) 25548, 25549, 25550, 25836, 25837

25945 **(NP—5770208) Stimulus programme of the Federal Authority for Economic Problems. Comparative tests: UF-site-foam thermal insulation.** (Bundesamt fuer Konjunkturfragen, Bern (Switzerland)). Dec 1983. 5p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE85770208.

UF foam insulation are Urea-Formaldehyde foam products which are produced on site as thermal insulating foam for cavity filling in buildings. They are particularly suited for thermo-technical improvements in cavities of extremely difficult access. UF on-site foam hardens on cooling and is prepared with air pressure. The tests were carried out with regard to bulk density, reactivity, impact test, drip test, the determination of free formaldehyde in the resin solution, form stability under temperature influences, incendiary code number etc. The tests shown in the tables of comparison are guideline values worked out on the basis of the experience of the test institutes and manufacturers. Testing standards and quality requirements do not yet exist in Switzerland.

25946 **Improved multi-directional eddy current inspection test apparatus for detecting flaws in metal articles.** Nance, R.A.; Caffarel, A.J.; Hartley, W.H. (to Dept. of Energy). US Patent 4,480,225. 30 Oct 1984. Filed date 11 Feb 1982. vp.

PAT-APPL-347759.

Apparatus is described for detecting flaws in a tubular workpiece in a single scan. The coils of a dual coil bobbin eddy current inspection probe are wound at a 45° angle to the transverse axis of the probe, one coil having an angular position about the axis about 90° relative to the angular position of the other coil, and the angle of intersection of the planes containing the coils being about 60°.

25947 **Fixture for holding testing transducer.** Wagner, T.A.; Engel, H.P. (to Dept. of Energy). US Patent 4,479,387. 30 Oct 1984. Filed date 23 Nov 1982. vp.

PAT-APPL-443986.

A fixture for mounting an ultrasonic transducer against the end of a threaded bolt or stud to test the same for flaws. A base means threadedly secured to the side of the bolt has a rotating ring thereon. A post rising up from the ring (parallel to the axis of the workpiece) pivotally mounts a variable length cross arm, on the inner end of which is mounted the transducer. A spring means acts between the cross arm and the base to apply the testing transducer against the workpiece at a constant pressure. The device maintains constant for successive tests the radial and circumferential positions of the testing transducer and its contact pressure against the end of the workpiece.

25948 **Non-destructive testing method and apparatus utilizing phase multiplication holography.** Collins, H.D.; Davis, T.J.; Prince, J.M. (to Dept. of Energy). US Patent 4,476,434. 9 Oct 1984. Filed date 25 Jan 1982. vp.

PAT-APPL-342431.

An apparatus and method for imaging of structural characteristics in test objects using radiation amenable to coherent signal processing methods. Frequency and phase multiplication of received flaw signals is used to simulate a test wavelength at least one to two orders of magnitude smaller than the actual wavelength. The apparent reduction in wavelength between the illumination and recording radiation performs a frequency translation hologram. The hologram constructed with a high synthetic frequency and flaw phase multiplication is similar to a conventional acoustic hologram construction at the high frequency.

4208 Electronic Circuits And Devices

25940 **(CONF-850656—1) Simultaneous phase and frequency control of a three-phase inductor-convertor bridge.** Hirano, M.; Skiles, J.J.; Kustom, R.L. (Wisconsin Univ., Madison (USA). Dept. of Electrical and Computer Engineering; Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85006197.

From 16. IEEE annual PESC conference; Toulouse, France (24 Jun 1985).

The Inductor-Convertor Bridge (ICB) is a dc-ac-dc convertor network which allows controllable energy transfer between two superconducting coils. Since an ICB system is asynchronous, both phase and frequency are controllable, and offer improved performance. Simultaneous open-loop phase angle control and closed-loop frequency control has been investigated analytically and demonstrated on a three-phase model using two 4-Hy superconducting coils.

25950 **(LA—10238-T) Repetitive energy transfers from an inductive energy store.** Honig, E.M. (Los Alamos National Lab., NM (USA)). Mar 1985. Contract W-7405-ENG-36. 174p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85011884.

This dissertation details the theoretical and experimental results of a research program aimed at finding practical ways to transfer energy repetitively from an inductive energy store to various loads. The objectives were to investigate and develop the high power opening switches and transfer circuits needed to enable high-repetition-rate operation of such systems. The requirements of nonlinear, time-varying loads were also addressed. Energy storage capability is needed for proper power conditioning in systems where the duty factor of the output pulse train is low. Inductive energy storage is attractive because it has both a high energy storage density and a fast discharge capability. However, to transfer energy from a coil or inductor to a load, an opening switch must be used to interrupt the current and insert the load into the circuit. The switch must carry the large coil current during the storage time, interrupt the current, and then withstand the high voltage generated by the coil current flowing through the load. The opening switch problem is difficult enough for single-shot operation in many applications, but it becomes formidable when repetitive operation is required. By producing a pulse train with a peak power of 75 MW at a pulse repetition rate of 5 kpps in a one-ohm load system, this research program was the first to demonstrate fully-controlled, high-power, high-repetition-rate operation of an inductive energy storage and transfer system with survivable switches. Success was made possible by using triggered vacuum gap switches as repetitive, current-zero opening switches and developing several new repetitive transfer circuits using the counterpulse technique. A detailed analysis of the switching and transfer process was made and the dependency of the output pulse risetime on specific load conditions was determined. 105 refs.

25951 **(PB—85-162238/XAB) Toshiba Review, Volume 40, No. 1, 1985.** (Toshiba Corp., Tokyo (Japan). Principal Office). [1985]. 87p. (In Japanese). NTIS, PC E05/MF E01.

See also PB85-162246 through PB85-162287. Color illustrations reproduced in black and white.

Special Issue on Power Electronic Technology featuring: Low-Noise Switching Power Supplies for Electronic Apparatus; High-Efficiency Power Supplies for Solid-State Power Amplifiers for Broadcasting Transmitters; Power Supply Complying with International Regulations for Personal Computers; New Type Uninterruptible Power Supply, TOSNIC-2000 Series; Power Supplies for Office Automation Apparatus; DC-DC Converter for Trolley Bus; Standardized Modular Power Supplies for Processing Equipment; Ion Engine Power Conditioner on Board ETS-III; Engineering Trends of Switching Power Supplies Using Amorphous Saturable Core. Also includes Tech Notes and information on Patents and Licenses.

25952 **(SAND—84-2136C) Study of Co and Mn in ZnO varistors.** Pike, G.E.; Seager, C.H.; Dosch, R.G. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 7p. (CONF-850421—4). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85011193.

From 2. spring meeting of the Materials Research Society; San Francisco, CA, USA (15 Apr 1985).

ZnO varistors are polycrystalline materials which have highly nonlinear current/voltage characteristics controlled by depletion regions around the grain boundaries. Dissolved transition metals at concentrations of about 1 at. % are required to achieve this large nonlinearity, but their role is unclear. To address this issue we have used the technique of photothermal deflection spectroscopy to measure the optical absorption of varistors containing Co or Mn, both common dopants. Prominent peaks and edges appear in the spectra, and are associated with substitutional Co^{2+} and Mn^{2+} ions whose ground states are deep within the ZnO bandgap. Electro- and photoluminescence spectra show Stokes shifted peaks for some of these transitions. The spectral dependence of the photoconductivity shows that some of the absorption features correspond to ionization of the impurities. This result is used to show how the dark impact ionization of these impurities due to a high applied voltage can contribute to the current/voltage nonlinearity.

25953 **(UCID—20377) Scale model measurements of the Lakehurst EMP simulator.** Hudson, H.G.; Breakall, J.K. (Lawrence Livermore National Lab., CA (USA)). 6 Mar 1984. Contract W-7405-ENG-48. 68p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85010535.

The Navy is currently spending many millions of dollars on EMP system testing. The primary EMP test facility in the United States is at Kirtland Air Force Base in New Mexico. Utilization of these facilities requires obtaining a test contract, with the Air Force Weapons Laboratory being the directors of the test operation and flying the aircraft to New Mexico with any special ground handling equipment for the care and feeding of the test aircraft. These facilities are subject to thundershowers during the summer months or at best, very cold weather during the winter months. Therefore, a feasibility study has been undertaken to determine if an HPD style simulator can be located indoors using one of the large blimp hangers at the Naval Air Engineering Center at Lakehurst, New Jersey. The purpose of this effort is to: (1) determine the least amount of the metal hangar roof that would have to be replaced by a nonconducting material to greatly reduce or eliminate the unwanted roof reflections, (2) determine the effect of the neighboring hangar, and (3) determine any residual effects of the wooden support structure.

25954 **(UCID—20409) CAE Tool Catalog.** Wahler, P.S.; Poggio, M.E. (Lawrence Livermore National Lab., CA (USA)). Feb 1985. Contract W-7405-ENG-48. 81p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85011290.

The purpose of the catalog presented is to provide concise information regarding computer-based engineering tools which aid electronics engineers in their work. The catalog centralizes information about such tools and provides easy access to the tool information. The catalog resides on a VAX in the integrated Computer-Aided Engineering network. Computer codes are described in these applications: circuit simulation and analysis; control simulation and analysis; digital logic design; digital logic simulation; electromagnetic modeling; graphics; plasma modeling; probability analysis; schematic capture; semiconductor modeling; signal processing; text processing; and utility. (LEW)

25955 **(UCRL—91888) Upgrade of the LLNL EM transient range monocone antenna.** King, R.J.; Kunz, K.S.; Hudson, H.G.; Boberg, R.E.; Pennock, S.T.; Gnade, D.K. (Lawrence Livermore National Lab., CA (USA)). Dec 1984. Contract W-7405-ENG-48. 6p. (CONF-850669—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85006639.

From North American radio science meeting; Vancouver, Canada (17 Jun 1985).

Lawrence Livermore National Laboratory has operated an electromagnetic transient range facility (EMTRF) since 1968 using a succession of antennas. This report describes the latest upgrade involving a precision monocone antenna and the use of a shroud of EM absorbing material strategically placed around the antenna to significantly enhance the clear time. This upgrade has resulted in highly repeatable measurements of exterior and interior responses of test objects for frequencies up to approximately 3 GHz for times on the order of hundreds of nanoseconds. Highly resonant interior responses can now be resolved experimentally. The radiated signal is nearly as clean as that from a simple vertical radiator and the field intensity is 12 dB larger. The cone is very nearly a true conic with very small azimuthal variations. As expected, the field behaves as 1/r for periods on the order of the time required for the transient pulse to reach the cone edge. This perturbation is minimized by the use of strategically placed EM absorber which also serves to increase the clear time by minimizing room reflections. With improved pulsers it may be possible to extend the range of operation of this facility to 10-12 GHz.

25956 **High voltage RF feedthrough bushing.** Grotz, G.F. (to Dept. of Energy). US Patent 4,484,019. 20 Nov 1984. Filed date 3 Sep 1982. vp.

PAT-APPL-414543.

Described is a multi-element, high voltage radio frequency bushing for transmitting RF energy to an antenna located in a vacuum container. The bushing includes a center conductor of complex geometrical shape, an outer coaxial shield conductor, and a thin-walled hollow truncated cone insulator disposed between central and outer conductors. The shape of the center conductor, which includes a reverse curvature portion formed of a radially inwardly directed shoulder and a convex portion, controls the uniformity of the axial surface gradient on the insulator cone. The outer shield has a first substantially cylindrical portion and a second radially inwardly extending truncated cone portion.

25957 **Radio frequency communication system utilizing radiating transmission lines.** Struven, W.C. (to Dept. of Energy). US Patent 4,476,574. 9 Oct 1984. Filed date 23 Aug 1982. vp.

PAT-APPL-410785.

A radio communication system for use in tunnels, mines, buildings or other shielded locations in which a pair of radiating transmission lines extend through such location in spaced coextensive relation to each other. Each transmission line has at least one unidirectional amplifier interposed therein with the sense of the unidirectional amplifier of one transmission line being opposite to the sense of the unidirectional amplifier of the other transmission line. Each of the amplifiers has a gain which is less than the coupling loss between the transmission lines. Two or more mobile transceivers in the location served by the system are coupled to the transmission lines by electromagnetic wave propagation in space in order to communicate directly with each other at a given radio frequency within the frequency range of the system.

25958 **Biasing and fast degaussing circuit for magnetic materials.** Dress, W.B. Jr.; McNeilly, D.R. (to Dept. of Energy). US Patent 4,471,403. 11 Sep 1984. Filed date 4 Oct 1983. vp.

PAT-APPL-539011.

A dual-function circuit is provided which may be used to both magnetically bias and alternately, quickly degauss a magnetic device. The circuit may be magnetically coupled or directly connected electrically to a magnetic device, such as a magnetostrictive transducer, to magnetically bias the device by applying a d.c. current and alternately apply a selectively damped a.c. current to the device to degauss the device. The circuit is of particular value in many systems which use magnetostrictive transducers for ultrasonic transmission in different propagation modes over very short time periods.

25959 **Layered ultra-thin coherent structures used as electrical resistors having low temperature coefficient of resistivity.** Werner, T.R.; Falco, C.M.; Schuller, I.K. (to Dept. of Energy). US Patent 4,454,495. 12 Jun 1984. Filed date 31 Aug 1982. vp.

PAT-APPL-413637.

A thin film resistor having a controlled temperature coefficient of resistance (TCR) ranging from negative to positive degrees kelvin and having relatively high resistivity. The resistor is a multilayer superlattice crystal containing a plurality of alternating, ultrathin layers of two different metals. TCR is varied by controlling the thickness of the individual layers. The resistor can be readily prepared by methods compatible with thin film circuitry manufacturing techniques.

4209 Waste Processing Plants And Equipment

REFER ALSO TO CITATION(S) 25776, 26072

25960 **(AD-A—149617/3/XAB) Waste assessment method for Navy shore activities. Proposed survey method. Phase II. Final report, March 1983-March 1984.** Zimmerle, J.; Monsabert, S.D.; Chatterjee, A. (Naval Civil Engineering Lab., Port Hueneme, CA (USA)). Oct 1984. 68p. (NCEL-TN—1712). NTIS, PC A04/MF A01.

This report provides details on a waste assessment method for obtaining data on the characteristics and degree of availability of the solid waste generated at a Navy activity. The data will be used in the design of a waste-to-energy facility, such as a heat recovery incinerator (HRI) or a resource recovery facility. The assessment method is conducted on 25 to 30 randomly chosen days over a 1-year period. The use of standard statistical techniques adds validity to the evaluation methodology and ensures that the results can be used with confidence in a waste-to-energy facility design. Statistical data on quantity, composition, and fuel characteristics are generated through the waste assessment method and are expressed in terms of the mean, standard deviation, and the variance of these parameters. The proposed survey methodology involves three steps: 1. Determine the number of samples required to achieve a specified level of data validity. 2. Develop a sampling schedule, and then use the three sampling techniques to collect data for the statistical analysis. 3. Use the statistical analysis procedure to characterize the Navy activity wastes based on sample results.

4210 Combustion Systems

REFER ALSO TO CITATION(S) 25137, 25138, 25201, 25728

25961 **(EUR—9310-EN) Report on the characterization of a gas controlled heat pipe furnace.** McAllan, J.V. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1984. 40p. Commission of the European Communities, Luxembourg.

The gas-controlled heat pipe furnace investigated in this work was developed in the physical Engineering Section of the Joint Research Centre, Ispra Establishment, of the Commission of the European Communities. The furnace contains an annular gas-controlled heat pipe about 600 mm long with an inner diameter of 27 mm, built from inconel 601 with sodium as working fluid and helium as control gas. After minor modifications of the furnace initial measurements were made below 625°C. Instabilities were detected in the heat pipe behaviour and these were investigated in detail before taking the heat pipe above 800°C, since it was anticipated that the resistance thermometers would show instability above this temperature. Measurements were then made at 850, 900 and 962°C. No measurements were made above 962°C, because it was clear that instabilities in the thermometers were much larger than variations in the heat pipe.

25962 **(NP—4901601) Development of low Btu gas burner for industrial application, Phase III. Final report.** Mac Minn, C.L.; Williamson, F.D.; Schaus, O.O.; Khoo, S.W. (Canadian Gas Research Inst., Don Mills, Ontario). Oct 1980. 31p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84901601.

The Canadian Gas Research Institute has designed and constructed a 300 kW (1,000,000 Btu/h) burner for low energy gas. The burner was field tested at the site of a wood gasifier. The burner was tested with both cleaned and "dirty" low energy gas. The firing rate was varied from 150 to 300 kW. Flame properties were controlled by varying the ratio of primary to secondary air. The burner proved suitable for gases with heating values from 3 to 6 MJ/m³ (80 to 160 Btu/ft³). It also proved suitable for use with "dirty" gas. The important parameters for scaling up the burner design were determined. Recommendations are made for various factors in burner construction.

25963 **(SAND—84-8022) Experimental investigation of an unsteady combusting flow in a pulse combustor.** Keller, J.O.; Saito, K. (Sandia National Labs., Livermore, CA (USA); Toshiba Corp., Fuji City (Japan)). Jan 1985. Contract AC04-76DR00789. 18p. (CONF-850136—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE85006289.

From 23. AIAA aerospace sciences meeting; Reno, NV, USA (14 Jan 1985).

Pulse combustion devices exhibit exceedingly high thermal efficiency and very low pollutant emission when used in heating applications. Application of these heating devices has been limited, however, because of a lack of understanding of the fundamental controlling physical and chemical processes governing pulse combustors. An experimental research program has been initiated at Sandia National Laboratories to develop such insight. This paper reports the results of an experiment studying the effects of changing heat release and pressure pulsations on the fluid dynamics in the combustion chamber of a square pulse combustor. Using a two-color laser Doppler velocimeter (LDV) as a diagnostic tool, this study indicates that the fluid dynamics in the combustion chamber are strongly affected by pressure pulsations and are weakly affected by a change in the heat release rate.

25964 **Characterization and comparison of the corrosive environment in Battelle's 0.28 m² and Rocketdyne's 3.24 m² Fluidized-bed coal combustor.** Wright, I.G.; Campbell, J.; Rocazella, M.A. (Battelle Columbus Laboratories, Columbus, OH). pp 12 of Corrosion '84. Houston, TX; NACE (Apr 1984). (CONF-840405—).

From NACE corrosion '84 international forum and exhibition; New Orleans, LA, USA (1 Apr 1984).

An in-situ oxygen probe was used to determine the corrosion potential (oxygen partial pressure) of the in-bed environment inside two fluidized-bed coal combustors with similar internal configurations. Both FBC's contained potentially dangerous corrosive environments in the bottom of the bed, near the coal feedd nozzles, and along the walls. Several design modifications were implemented in an attempt to reduce the occurrence and severity of these environments and their effectiveness is discussed.

4220 Underground Engineering

25965 **(SAND—85-0662C) Application of propellants for controlled pressurization of boreholes in geologic media.** Cuderman, J.F. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 12p. (CONF-850614—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE85009504.

From ASME-ASCE fluids engineering conference and joint mechanics conference; Albuquerque, NM, USA (24 Jun 1985).

Experiments have been conducted in ash-fall tuff and in Appalachian Devonian shale using propellants for controlled pressurization and fracturing of wellbores. Experimental measurements include borehole pressure history, radial and tangential stress and acceleration produced in the formation, and pretest and posttest formation transmissivity and borehole tv scans. For ash-fall tuff experiments conducted at the Department of Energy's Nevada Test Site, mineback was conducted to reveal fracturing behavior. The pressure risetime is found to be the key variable governing fracture behavior. Depending on choice of propellant, one can specify burn rates to obtain single or multiple fracture planes or borehole crushing. The peak pressure attained is of a secondary importance and appears to be a function of in situ stress and loading rate. While this paper summarizes the results of experiments in ash-fall tuff and Devonian shale, the fracture technique developed appear to be generally applicable to most rock types. Other potential applications are briefly summarized including use of propellant fracturing technique for tailored dynamic loading of geologic media.

4230 Marine Engineering

25966 **(PB—85-159184/XAB) Influence of ambient air pressure on impact pressure caused by breaking waves.** Moutzouris, C. (Technische Hogeschool Delft (Netherlands). Dept. of Civil Engineering). [1985]. 119p. (R—10-79). NTIS, PC E06/MF E01.

Engineers are interested in the dynamics of the interface water structure. In case of breaking of water waves on a structure, high positive and sometimes negative pressures of very short duration occur. Not only the maxima and minima of the pressures on the structure are important to a designing engineer, but also the pressure-time history: failure of the structure may occur when for the first time the pressure reaches a certain level or when the accumulation of small damages due to lower pressures reaches a certain level. The breaking of water waves on the structure is a process in a three-phases-system, because almost always air is entrapped in the mass of the breaking wave. The large number of parameters which control the developed pressures can be classified in three groups, according to the three phases water, solid, air.

25967 **(PB—85-163954/XAB) Centrifuge modelling of artificial sand islands in earthquakes.** Lee, F.H.; Schofield, A.N. (Cambridge Univ. (UK). Dept. of Engineering). 1984. 41p. NTIS, PC E04/MF E01.

Increasingly over the past decade, artificial islands have been constructed for various purposes, most having been constructed in less than 13 m of water with relatively unprotected slopes and with short design lives. However, as oil and gas exploration and production and as port expansion move to deeper waters and the need for more secure and economical designs for such islands develops, more complex forms of island construction have evolved, such as the use of sand-filled caissons on submarine berms. Where artificial sand islands are constructed in seismically active regions, the behaviour of these soil structures in earthquakes has to be considered. Little quantitative data is currently available on the response of artificial islands to earthquakes, one of the better known sets of data being the pore pressure and acceleration records collected from Owi Island.

4240 Pollution Control Equipment

REFER ALSO TO CITATION(S) 25327

25968 **(NP—5770209) Development of a light scattering technique for particle size spectrometry.** Sakbani, K. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Maschinenbau). 16 Feb 1983. 152p. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number DE85770209.

Experimental and theoretical investigations are presented on the application of a light scattering technique for particle size spectroscopy. A multi ratio measuring procedure is developed and the relation between the probe volume of the system and the particle size allows for an error analysis. Based on statistical arguments, a simulation method is described for the complete measuring chain together with an evaluation procedure.

25969 **Liquid sampling system.** Larson, L.L. (to Dept of Energy). US Patent Application 6-648,211. 17 Sep 1984. 23p. Contract AC07-79ID01675.

A conduit extends from a reservoir through a sampling station and back to the reservoir in a closed loop. A jet ejector in the conduit establishes suction for withdrawing liquid from the reservoir. The conduit has a self-healing septum therein upstream of the jet ejector for receiving one end of a double-ended cannula, the other end of which is received in a serum bottle for sample collection. Gas is introduced into the conduit at a gas bleed between the sample collection bottle and the reservoir. The jet ejector evacuates gas from the conduit and the bottle and aspirates a column of liquid from the reservoir at a high rate. When the withdrawn liquid reaches the jet ejector the rate of flow therethrough reduces substantially and the gas bleed increases the pressure in the conduit for driving liquid into the sample bottle, the gas bleed forming a column of gas behind the withdrawn liquid column and interrupting the withdrawal of liquid from the reservoir. In the case of hazardous and toxic liquids, the sample bottle and the jet ejector may be isolated from the reservoir and may be further isolated from a control station containing remote manipulation means for the sample bottle and control valves for the jet ejector and gas bleed. 5 figs.

25970 **Evaluation of an ultra-high-volume airborne particulate sampler, the LEAP.** Tu, K.W. (Dept. of Energy, New York, NY). *American Industrial Hygiene Association Journal;* 45: No. 6, 360-364(Jun 1984).

A modified ultra-high-volume liquid electrostatic aerosol precipitator sampler (LEAP) was calibrated with near monodisperse aerosols of water-soluble and insoluble materials in the size range of 0.02 to 4 μm diameter. The water-soluble materials were ammonium sulfate and ammonium hydrogen sulfate. The insoluble materials included carnauba wax, stearic acid, silver chloride and Y(THD)$_3$. The particulate collection efficiency of the unit ranged from 40 to 98%, depending on particle size, sampling air flow and also on particle material. Tests with water-soluble aerosols showed higher collection efficiency than those with the insoluble aerosols by about 2 to 10%. A sharp decline in the collection efficiency for the particles smaller than 0.1 μm was observed. A comparison with the available manufacturer's data for the particle diameters of 0.1 to 3 μm suggests that the manufacturer overestimated the collection efficiency by 6 to 20% for an air flow of 10 m^3/min. The LEAP is considered to be a useful ultra-high volume sampler, especially suited for low-level or short-term sampling.

4250 Power Cycles

25971 **(UCID—30200-83-1) RANKINE: a graphics-augmented interactive program for designing Rankine power cycles.** Davis, B.W. (Northern Arizona Univ., Flagstaff (USA); Lawrence Livermore National Lab., CA (USA)). 7 Sep 1983. Contract W-7405-ENG-48. 50p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85011364.

RANKINE is an interactive program which provides the user with a design/analysis tool to aid in designing thermodynamic power cycles for steam power plants. The software is formulated to give simultaneous displays, on separate monitors, of the graphic and alphanumeric responses to design decisions. RANKINE is written in Microsoft Basic (MBasic) and is intended to operate in a CP/M environment; modification will be required for other operating systems. Temperature-Entropy property coordinates describe the thermodynamic processes undergone by the H_2O as it passes through the various mechanical components that produce the cycle. The processes become graphically displayed as the user makes the various design decisions en route to compositing a power cycle. System prompts and software interlocks are designed into RANKINE to make it easy for the user to proceed comfortably through the sequence of operations leading to a cycle design. After a design has been completed, the system offers the user an opportunity to make design changes. The effects of design changes become graphically discernible through successive overlays of cycles on the graphics monitor. A summary of the cycle performance, pertinent energy transfers, and other engineering consequences of the design specifications is offered to the user as an option. The summary can be presented in the form of CRT display or hard copy, at the user's discretion. A typical hard-copy summary is presented. The current version of RANKINE allows the user to choose any practical combination of regenerative events and reheat events for a cycle design. Steam bleed points and extraction for reheat are arbitrarily chosen by the code user. Turbine and pump losses are accounted for by user-input specifications. An illustration of the use of this program, showing user/system interactions is given. 4 refs., 10 figs.

43 PARTICLE ACCELERATORS

4301 Design, Development, And Operation

REFER ALSO TO CITATION(S) 26000, 26507

25972 **(BNL—35842) Cryogenics for the superconducting super collider: workshop proceedings.** (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 94p. (CONF-840193—Summ.). NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85010951.

From Workshop on cryogenics for the superconducting super collider; Upton, NY, USA (17 Jan 1984).

Attendance at the workshop and information meeting on Cryogenics for the SSC held at Brookhaven National Laboratory on January 17 to 19, 1984 consisted of 109 engineers and scientists from 19 industrial organizations and 18 laboratories and universities - CERN, DESY, Grenoble, KEK and Saclay were represented. About one-third of the participants were from Brookhaven National Laboratory and Fermi National Laboratory. Talks which concentrated on informing the audience of the present status of the SSC research and development activities and progress towards design of the components were given, experience with the cryogenic system of the Tevatron was reported, and a wrap-up session was held on the last day where each of the five workshop leaders gave a summary of their group's discussions and conclusions. A brief summary of these presentations is given, with the detailed information gathered by the group leaders forming the bulk of these proceedings.

25973 **(LA-UR—85-1402) Longitudinal tune control in synchrotrons.** Colton, E.P. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 4p. (CONF-850504—8). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010745.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

Dual rf systems that use fundamental and higher-harmonic cavities can be used to control the longitudinal tune in synchrotrons. The equations of motion and the Hamiltonian are defined for particle motion using dual rf systems. An example is considered using a second-harmonic system - it is shown, that as phi/sub s/ is increased, a substantial gain in bucket area over a single rf system can be realized by proper relative phasing of the first- and second-harmonic voltages. 6 refs., 3 figs.

25974 **(SAND—84-2292C) Beam dynamics in MABE.** Poukey, J.W.; Coleman, P.D.; Sanford, T.W.L. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 4p. (CONF-850504—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010670.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

MABE is a multistage linear electron accelerator which accelerates up to nine beams in parallel. Nominal parameters per beam are 25 kA, final energy 7 MeV, and guide field 20 kG. We report recent progress via theory and simulation in understanding the beam dynamics in such a system. In particular, we emphasize our results on the radial oscillations and emittance growth for a beam passing through a series of accelerating gaps. 12 refs., 8 figs.

25975 **Application of permanent magnets in accelerators and electron storage rings (invited).** Halbach, K. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Journal of Applied Physics;* **57**: No. 8, 3605-3608(15 Apr 1985). Contract AC03-76SF00098.

After an explanation of the general circumstances in which the use of permanent magnets in accelerators is desirable, a number of specific magnets will be discussed. That discussion includes magnets needed for the operation of accelerators as well as magnets that are employed for the utilization of charged particle beams, such as the production of synchrotron radiation.

25976 **SLAC linear collider the machine, the physics, and the future.** Richter, B. (Stanford Univ., CA). *AIP (American Institute of Physics) Conference Proceedings;* No. 81, 433-460(1982). (CONF-810986—). Contract AC03-76SF00515.

From Meeting of the division of particles and fields of the American Physical Society; Santa Cruz, CA, USA (9 Sep 1981).

The Stanford Linear Collider (SLC) is briefly described and new problems in accelerator physics related to linear colliders are discussed. Beam dynamics, luminosity, yields and energy spread are considered. Possible experiments with very high energy colliders are described and some specific aspects of the collider program at SLAC are discussed.

4302 Beam Dynamics, Field Calculations, And Ion Optics

REFER ALSO TO CITATION(S) 25973, 26008, 26422

25977 **(BNL—36172) Experience with a high-brightness storage ring: the NSLS 750 MeV vuv ring.** Galayda, J. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 14p. (CONF-8409163—5). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010547.

From Workshop on coherent and collective propagation of relativistic E-beams and electromagnetic radiation; Villa Olmo, Como, Italy (13 Sep 1984).

The NSLS vuv ring is the first implementation of the proposals of R. Chasman and G.K. Green for a synchrotron radiation source with enhanced brightness: its lattice is a series of achromatic bends with two zero-gradient dipoles each, giving small damped emittance; and these bends are connected by straight sections with zero dispersion to accommodate wigglers and undulators without degrading the radiation damping properties of the ring. The virtues of the Chasman-Green lattice, its small betatron and synchrotron emittances, may be understood with some generality; e.g. the electron $\gamma m_0 c^2$ energy and the number of achromatic bends M sets a lower limit on the betatron emittance of e/sub x/ $> 7.7 \times 10^{-13} \gamma^2/M$ meter-radians. There is strong interest in extrapolation of this type of lattice to 6 GeV and to 32 achromatic bends. The subject of this report is the progress toward achieving performance in the vuv ring limited by the radiation damping parameters optimized in its design. 14 refs., 4 figs., 1 tab.

25978 **(BNL—36302) Combined function lattices for a 6 GeV synchrotron light source.** Vignola, G. (Brookhaven National Lab., Upton, NY (USA)). 1985. Contract AC02-76CH00016. 4p. (CONF-8505133—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010959.

From Machine workshop on 6 GeV synchrotron radiation source; Washington, DC, USA (28 May 1985).

Some characteristics of the "undulator" machine proposed a few months ago are discussed. The basic cell is an achromatic arc with three dipoles, having a vertical focusing gradient. The optical functions are shown and the main machine parameters are listed. This machine seems to have a resonable dynamic aperture and a good chromatic behavior but has period length of ~ 35 m. The reduction of the period length implies a reduction of the dynamic aperture. The results are summarized and the corresponding dynamic apertures are shown.

25979 **(CONF-850641—1) 3D calculations of a fixed field alternating gradient synchrotron magnet.** Lari, R.J. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002742.

From 5. conference on the computation of electromagnetic fields; Ft. Collins, CO, USA (3 Jun 1985).

A Spallation neutron source for materials science studies was designed at Argonne and required a fixed field alternating gradient (FFAG) synchrotron magnet. 3D electrostatic calculations were made to obtain the unsaturated magnet pole shape. This pole shape was refined using 3D magnetostatic calculations that included the steel permeability and coil geometry. Details of the calculations are given concerning such things as: size of the problem and how to split it up, the number and shape of the finite elements, choosing the electrostatic potential correctly and selecting the potential of the desired pole. 5 figs.

25980 **(FNAL-TM—1302) Guide to the Main Ring DO overpass.** Turkot, F. (Fermi National Accelerator Lab., Batavia, IL (USA)). 20 Mar 1985. Contract AC02-76CH03000. 52p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85011722.

The DO overpass is a modification of the beam orbit in Main Ring in order to better accommodate a Tevatron collider detector at DO. The orbit is moved up ~ 51 inches over most of the long straight section at DO, thus making the Main Ring the world's first non-planar proton synchrotron. A similar overpass, but with four times the displacement, is planned for the CDF detector at the BO straight section. The nominal separation between the beam orbit in the Main Ring and the orbit in the Tevatron is 25.5 inches. Early in the design study of a detector that would utilize the Tevatron is a anti pp collider, it was apparent that a larger separation at the detector was highly desirable. In 1981, Tom Collins proposed a specific lattice geometry in the Main Ring for achieving larger separation, called "the screw beam". His proposal has served as the basis for the design of both the BO and DO overpasses. The main purpose of this report is to describe in some detail the implementation of the DO overpass. Topics to be covered include: (a) geometry of the overpass orbit, (b) the new hardware in the tunnel, (c) the power supply system, (d) the control facility, (e) accelerator beam dynamics ramifications, and (f) commissioning experience. A secondary purpose is to provide a fairly complete "bibliography" to the sources of information on the overpass. 17 refs., 17 figs.

25981 **(JINR-R—9-83-90) Calculation of a toroidal magnet field by the finite element method.** Vorozhtsov, S.B. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1983. 8p. (In Russian). (CONF-8305103—3). NTIS (US Sales Only), PC A02/MF A01. File Number DE85700605.

From COMPUMAG conference on the computation of electromagnetic fields; Genoa, Italy (30 May 1983).

Finite element method has been used for the calculation of the 3-dimensional field inside the iron core of the CERN NA-4 spectrometer. Computer program based on this method has been written exeptionally for the above mentioned magnet. The obtained field map has been compared with the existent data on magnetic field measurements and with various computed field models.

25982 **(LA-UR—85-1151) Comparison of simulation with experiment in an RFQ.** Boicourt, G.P.; Sander, O.R.; Wangler, T.P. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 4p. (CONF-850504—4). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010770.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

The accelerator test stand (ATS) RFQ has provided an opportunity to compare the predictions of the RFQ beam-dynamics code PARMTEQ with actual operation of an RFQ. For this comparison, the code was adapted to simulate the measured operation parameters, which are somewhat different from those of the ideal design. A Monte Carlo code was written to provide input to PARMTEQ, based on measured input beam distributions. With these refinements, the code has given results that are in good agreement with measurements and has provided information leading to an explanation of an unexpected set of measurements. This paper describes the method used to generate a pseudo particle beam based on the measured transverse properties of the RFQ input beam and describes some of the comparisons between simulation and experiment. An explanation is provided for the energy-spectrum structure observed in the RFQ output beam during low-voltage operation. 3 refs., 7 figs.

25983 **(LA-UR—85-1193) Moments in particle-in-cell simulations.** Berz, M.M.; Lysenko, W.P. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 4p. (CONF-850504—9). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010792.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

The moment equations that form the basis of the BEDLAM simulation code can also be used as a check on Particle-In-Cell (PIC) simulations. Moments can be computed as sums over the macroparticles used in the PIC simulations. These moments should satisfy the moment equations if the simulation is valid. A check has been done to sixth order for two cases: the RFQRZP code, which simulated a radio-frequency quadrupole (RFQ) linac, and the BEAMTRACE code, which simulated the final focusing system in a heavy ion fusion facility. Because our modified PIC codes were able to compute moments that satisfied the correct moment equations, we were able to use our modified version of RFQRZP, which we called RFQMOM, to work on another problem. Every moment simulation code has to include some truncation approximation. The error of this approximation can be determined by RFQMOM before actually writing the moment code. As an example, we investigated the accuracy of the truncation approximation that is used in the BEDLAM code. 6 refs., 4 figs.

25984 **(LA-UR—85-1328) Circular-beam ray tracing on a microcomputer.** Schneider, J.D. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 3p. (CONF-850504—20). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010754.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

A computer code is described that traces charged particles through a system of electrostatic and magnetic solenoid lenses. This code requires symmetry about the beam axis, but it incorporates a useful approximation for handling beam emittance and variable space-charge neutralization. It features a friendly and versatile user interface and runs efficiently on an Apple II microcomputer.

25985 **(LA-UR—85-1332) 3lambda/4 post coupler for drift-tube linacs.** Billen, J.H.; Garcia, J.A.; Potter, J.M.; Spalek, G. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 4p. (CONF-850504—13). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010753.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

New permanent magnets for quadrupole focusing make possible smaller drift tubes in drift-tube linacs (DTLs), resulting in higher shunt impedance. However, ordinary post couplers cannot stabilize a DTL whose drift-tube-to-wall spacing exceeds one-quarter wavelength ($\lambda/4$) by more than a few per cent for the accelerating mode frequency. We have built and tested post couplers that operate in the $3\lambda/4$ mode. These $3\lambda/4$ post couplers, when substituted for $\lambda/4$ couplers, had similar stabilization properties. In addition, the coupling between post and drift tube, and the post's resonant frequency can be independently adjusted. 5 refs., 5 figs.

25986 **(LA-UR—85-1401) Proposed use of the radio-frequency quadrupole structure to funnel high-current ion beams.** Stokes, R.H.; Minerbo, G.N. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 4p. (CONF-850504—21). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010746.

From Particle accelerator conference; Vancouver, Canada (13 May 1985)..

In this paper, we describe a new approach to funneling beams that are initially accelerated in two radio-frequency quadrupole (RFQ) accelerators. Instead of discrete optical elements, we propose to funnel within an RFQ structure, so that during the funneling process the beam is always confined by periodic transverse focusing. Beams with high space charge experience irreversible emittance growth when they emerge from a periodic focusing system. To alleviate this problem, in the proposed funneling system it should be possible to maintain the same focusing periodicity as that of the accelerators preceding the funnel. Also, instead of conventional deflection systems, we propose to use the properties of a modified RFQ structure to deflect two parallel beams toward each other and to merge them into a single final beam. 1 ref., 3 figs.

25987 **(LA-UR—85-1413) Emittance growth caused by current variation in a beam-transport channel.** Allison, P. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 4p. (CONF-850504—6). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010743.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

Time variation of space-charge forces in a beam-transport channel will lead to a time-averaged emittance growth of the beam. The Kapchinskii-Vladimirskii (K-V) equations have been used to follow the envelope of a round beam with effective beam current fluctuation i through a transport channel. The area of the ellipse that encloses the varying ellipses at the end has been used as the criterion for emittance growth. Simple formulae give the relation between i, initial emittance epilson, allowable fractional emittance growth Δ eta, effective average current I, average beam radius R, and transport length. For example, for a long transport channel a nominally compensated beam must have $i < (\beta\gamma\ \text{epsilon}^2 I_0/R^2)\Delta$ eta, where $I_0 = 4\pi\epsilon_0 Mc^3/e$, and $\beta\gamma$ is the usual relativistic factor. Results for other conditions are presented. A comparison with a numerical calculation from the TRACE code for transport of a 100-keV, 100-mA beam is made. 6 refs., 3 figs.

25988 **(LA-UR—85-1460) Recent results of the Los Alamos free-electron laser oscillator experiment.** Sheffield, R.L.; Warren, R.W.; Newnam, B.E.; Stein, W.E.; Goldstein, J.C.; Lynch, M T. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 10p. (CONF-8411153—4). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010736.

From International conference on lasers '84; San Francisco, CA, USA (2C Nov 1984).

Since the last Lasers '83 Conference, significant progress has been made on the Los Alamos free-electron laser (FEL). Although the previously reported results were in agreement with theory, the data were plagued by gain fluctuations, and no spectral measurements had been obtained. Since then, the source of the fluctuations has been analyzed and substantially reduced. Also, the optical power and spectra dependence on beam emittance, alignment, cavity length, energy spread, and current were systematically studied. This paper reports on the results obtained with a uniform-period wiggler. 3 refs., 14 figs., 2 tabs.

25989 **(LA-UR—85-1515) Accelerator column models for low-current beams.** Rusthoi, D.P.; Allison, P.; Crandall, K.R. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 4p. (CONF-850504—24). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010722.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

This paper describes three analytic approaches used to model electrostatic accelerator columns in beam-transport codes for low-current beams and compares the results of each approach with the results obtained by numerically calculating the electric field based on charge distribution on equipotential surfaces. The three analytic approaches described are (1) a cubic energy-gain approximation, (2) a cubic longitudinal electric-field approximation, and (3) the aperture equation. The first two approaches calculate impulse approximations at the apertures, whereas the third is an integration of particle trajectories through the column filed. The conditions under which the solutions tend to break down are discussed. 4 refs., 8 figs.

25990 **Dynamics of space-charge waves in the laser beat wave accelerator.** Tang, C.M.; Sprangle, P.; Sudan, R.N. (Plasma Theory Branch, Plasma Physics Division, U.S. Naval Research Laboratory, Washington, DC 20375-5000). *Physics of Fluids;* **28**: No. 6, 1974-1983(Jun 1985). Contract AI05-83ER40117.

The excitation of plasma waves by two laser beams, whose frequency difference is approximately the plasma frequency, is analyzed. Our nonlinear analysis is fully relativistic in the axial and transverse directions and includes mismatching of the laser beat frequency to the plasma frequency, time dependent laser amplitudes, and an applied transverse magnetic field (surfatron configuration). Our analytical results for the large amplitude plasma waves include an axial constant of motion, accelerating electric field, and its phase velocity. The analytical results in the weak laser power limit are in good agreement with numerical results obtained from the complete equations. The imposed transverse magnetic field is found to increase the effective plasma frequency, but has little effect on the plasma dynamics.

25991 **Betatron-synchrotron detrapping in a tapered wiggler free-electron laser.** Sprangle, P.; Tang, C.M. (Plasma Theory Branch, Plasma Physics Division, Naval Research Laboratory, Washington, DC 20375-5000). *Physics of Fluids;* **28**: No. 6, 2019-2021(Jun 1985). Contract AI05-83ER40117.

Betatron-synchrotron resonance detrapping is shown to take place when the wiggler magnetic field amplitude is tapered. This resonance exists even if the radiation wave fronts are not curved and is dependent on the transverse gradient of the tapered wiggler field.

4303 Auxiliaries And Components

REFER ALSO TO CITATION(S) 26327, 26364, 26366

25992 **(AD-A—150107/1/XAB) Theoretical study of collective ion acceleration in the Luce diode. Final report, July 1982-July 1983.** Sullivan, D.J.; Faehl, R.J. (Mission Research Corp., Albuquerque, NM (USA)). Nov 1984. 149p. NTIS, PC A07/MF A01.

The most successful collective ion acceleration to date has been observed when a relativistic electron-beam has been discharged in the Luce diode (dielectric anode) geometry. In these experiments the ratio of peak proton energy to beam kinetic energy has been as high as 30. The ion source is a plasma formed on the anode surface by electron impact ionization of the dielectric material. The diode physics, which couples the electron beam generation to the number of ions extracted from the plasma, is an essential feature of the acceleration mechanism in the Luce configuration. Simulations where the electron beam is injected through a preformed dense plasma are significantly different from those where the electron beam self-consistently determines the ion plasma density and dynamics in the diode. The main difference is in unstable wave growth. In the Luce diode the instability is predominant. In other localized plasma-source collective ion accelerators, the main acceleration takes place due to a hydrodynamic plasma free expansion. However, both Luce diodes and other plasma-source accelerators can display both mechanisms to some extent.

25993 **(BNL—36278) AGS broad band neutrino beam.** White, D.H. (Brookhaven National Lab., Upton, NY (USA)). 27 Feb 1985. Contract AC02-76CH00016. 24p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010954.

We describe the broad band neutrino beam in the north area of the AGS and discuss the calculation of the neutrino flux. The horns were initially designed by Robert Palmer and this beam has been used for almost all neutrino running at the AGS. All of the wide band running for E734 has been done in the beam we discuss. E734 is an experiment designed to measure elastic scattering of neutrinos and antineutrinos on electrons and protons. The detector is sufficiently large ($\approx$170 tons) that enough events can be detected to make precision measurements of cross sections. In particular, the reaction nu/sub μ/ + e $\rightarrow$ nu/sub μ/ + e has been detected with more than 100 events, requiring a detailed understanding of the beam characteristics for normalization.

25994 **(CERN/EF/RF—83-6) First results on a superconducting 350 MHz cavity at CERN.** Bernhard, P.; Cavallari, G.; Chiaveri, E.; Lengeler, H.; Weingarten, W. (European Organization for Nuclear Research, Geneva (Switzerland)). 27 Jul 1983. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700606.

At 4.2 K a 350 MHz single cell cavity had a maximum accelerating field Esub(acc) = 4.7 MV/m at $Q_0 = 3.2 \times 10^9$ ($Q_0 = 10^{10}$ at 2.7 K and low field). Electron loading was insignificant. The breakdown at an equatorial weld was thermally induced. The observed losses correspond to 8 W/m at 3 MV/m accelerating field.

25995 (DOE/ER/60142—2, pp 15-22) **Molecular ion beam irradiation facility.** Marino, S.A.; Rossi, H.H.; Randers-Pehrson, G. Jul 1984. NTIS, PC A18/MF A01. File Number DE84014885.

In Radiation physics, biophysics and radiation biology. Progress report, December 1, 1983-November 30, 1984.

The reconditioning as well as the changes and additions to the Radiological Research Accelerator Facility molecular ion beam previously located at Brookhaven National Laboratory is described. Improved cell irradiation features incorporated into the new RARAF at Nevis Laboratory are discussed and plans for facility testing are reviewed.

25996 **(LA-UR—85-1205) Phase and amplitude feedback control system for the Los Alamos free-electron laser.** Lynch, M.T.; Tallerico, P.J.; Higgins, E.F. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 4p. (CONF-850504—12). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010787.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

Phase and amplitude feedback control systems for the Los Alamos free-electron laser (FEL) are described. Beam-driven voltages are very high in the buncher cavity because the electron gun is pulsed at the fifth subharmonic of the buncher resonant frequency. The high beam loading necessitated a novel feedback and drive configuration for the buncher. A compensation cirucit has been added to the gun/driver system to reduce observed drift. Extremely small variations in the accelerator gradients had dramatic effects on the laser output power. These problems and how they were solved are described and plans for improvements in the feedback control system are discussed. 5 refs., 7 figs.

25997 **(LA-UR—85-1227) Los Alamos free-electron laser (FEL) rf system.** Tallerico, P.J.; Lynch, M.T. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 4p. (CONF-850504—23). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010719.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

The FEL rf system was designed for 3.6-MW rf pulses from two klystrons to drive two linacs and one deflection cavity at 1300 MHz. Two 108.33-MHz subharmonic buncher cavities and one fundamental buncher were also built, each powered by a 5-kW amplifier. A single phase-coherent source drives the various amplifiers as

well as the grid of the electron gun, which is pulsed at 21.67 MHz. The initial buncher system did not work as well as expected, and the first linac tank required more rf power than anticipated. The light output was extremely sensitive to amplitude and phase errors. More powerful klystrons were developed and installed, and a method was discovered for operating a single subharmonic buncher and allowing the first linac to complete the bunching process. This paper shows the actual configuration used to operate the laser and discusses future improvements.

25998 **(LA-UR—85-1403) Slow extraction at LAMPF II.** Colton, E.P. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 4p. (CONF-850504—5). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010744.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

Half-integer resonant extraction will be used to slow extract the 45 GeV proton beam from the LAMPF II main ring during a time spread of 1/6 sec. High extration efficiency is obtained by performing the extraction in a high-beta long straight section and by utilizing an electrostatic wire septum and iron septum. 3 refs., 4 figs.

25999 **(LA-UR—85-1508) Performance of an rf beam monitor on the NBS-Los Alamos racetrack microtron.** Young, L.M.; Cutler, R.I. (Los Alamos National Lab., NM (USA); National Bureau of Standards, Washington, DC (USA)). 1985. Contract W-7405-ENG-36. 4p. (CONF-850504—11). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010725.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

A prototype rf beam-position, current, and phase monitor has been used on the 100-keV injector beamline of the racetrack microtron (RTM) where performance was measured with the chopped and bunched beam. This monitor works with both a pulsed beam and a cw beam. The pulsed beam consists of beam pulses with a FWHM of 40 ns. The rf beam monitor was tested with beam currents from $\sim$ 50 to 600 μA. The rf beam monitor will be described and its performance will be reported. 6 refs., 5 figs.

26000 **(LBL—19033) Heavy ion medical accelerator options.** Gough, R.A.; Alonso, J.R. (Lawrence Berkeley Lab., CA (USA)). 1985. Contract AC03-76SF00098. 19p. (CONF-850164—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85011204.

From FNAL/ANL workshop on charged particle accelerators for cancer therapy; Batavia, IL, USA (24 Jan 1985).

This paper briefly explores the accelerator technology available for heavy ion medical accelerators in the mass range of 1 to 40 (protons through argon). Machines that are designed to produce the required intensities of a particular design ion, such as silicon (mass 28), can satisfy the intensity requirements for all lighter ions, and can produce beams with higher mass, such as argon, at somewhat reduced, but still useful intensity levels. They can also provide beams of radioactive ions, such as carbon-11 and neon-19, which are useful in diagnostic imaging and for directly verifiable treatments. These accelerators are all based on proven technology, and can be built at predictable costs. It is the conclusion of several design studies that they can be operated reliably in a hospital-based environment. 8 refs., 22 figs.

26001 **(SLAC-CN—294) Energy deposition and its effects on the E^+ capture section at Sector 20.** Kramer, J.F. (Stanford Linear Accelerator Center, CA (USA)). 29 Apr 1985. Contract AC03-76SF00515. 19p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010964.

The temperature profile and resulting stresses and strains of the capture section (positron source accelerator section) at Sector 20 were investigated. The Electron-Gamma Shower program, Version 4 (EGS4) was used to determine energy deposition. For a 31.68 kW, 33 GeV electron beam, the rate of energy deposition in the first accelerator disk downstream from the 90/10 tantalum-tungsten positron target was determined to be 0.56 kW. The calculated resulting temperature difference from the inner disk diameter to the outer disk diameter is 49.4°F. The inner diameter could then reach a temperature of 169.5°F. The maximum stress produced in this first disk would be a compressive stress of 4374 psi, also at the inner diameter.

26002 **(SLAC-CN—295) Additional muon calculations for the SLC positron source.** Nelson, W.R.; McCall, R.C. (Stanford Linear Accelerator Center, CA (USA)). 23 Apr 1985. Contract AC03-76SF00515. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85011212.

This note is an update to the muon calculations presented in CN-221 and takes into account: (1) a more complete muon production and transport model, including an estimate of wide angle production based on experimental data, (2) additional earth shielding that will be added on top and both sides of the 2/3 tunnel areas, and (3) a detailed analysis of the earth profile as it pertains to shielding in the direction of the SLAC site boundary. The highest annual dose at the SLAC boundary is found to be 13 mrem/year (4000 hours of operation at 50 kW), and this occurs at a horizontal angle of 0 degrees and a vertical angle of 3.6 degrees relative to the incident beam direction. Although the shielding criteria is 10 mrem/year at the site boundary, the radiation transport model becomes somewhat conservative at large distances from the shield, which should bring the 13 mrem/year number actually well below the criteria. This point is also about 28 feet above the roadway. Extension of this line may strike the ground in the Christmas tree farm beyond the SLAC boundary but there will be additional attenuation due to distance. We do not recommend that any additional shielding be added at this time. 4 refs., 1 fig.

26003 **(SLAC-PUB—3582) Detector problems at the SSC.** Wojcicki, S.G. (Stanford Linear Accelerator Center, CA (USA)). Feb 1985. Contract AC03-81ER40050;AC03-76SF00515. 16p. (CONF-850146—6). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010217.

From Aspen winter physics conference; Aspen, CO, USA (14 Jan 1985).

During the last couple of years there has been considerable concern expressed among the US high energy community as to whether detector limitations would prevent one from being able to fully exploit a luminosity of 10^{33} cm^{-2} sec^{-1} at a hadron-hadron high energy collider. As a result of these concerns, a considerable amount of work has been done recently in trying to understand the nature of potential difficulties and the required R and D that needs to be performed. A lot of this work has been summarized in the 1984 DPF Summer Study at Snowmass. This paper attempts to review some of these results. This work is limited to the discussion of detector problems associated with the study of high energy hadron-hadron collisions. We shall start with the discussion of the desirable features of the detectors and of the SSC environment in which they will have to work. After a brief discussion of the model 4π detectors, we shall discuss specific detector aspects: lepton identification, tracking, calorimetry and computing and triggering. We shall end with some remarks about possible future course of events. 15 refs., 10 figs.

26004 **(SLAC-PUB—3620) Application of GPS in a high precision engineering survey network.** Ruland, R.; Leick, A. (Stanford Linear Accelerator Center, CA (USA); Air Force Geophysics Lab., Hanscom AFB, MA (USA)). Apr 1985. Contract AC03-76SF00515. 11p. (CONF-8504111—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010556.

From 1. international symposium on precise positioning with the global positioning system; Rockville, MD, USA (15 Apr 1985).

A GPS satellite survey was carried out with the Macrometer to support construction at the Stanford Linear Accelerator Center (SLAC). The network consists of 16 stations of which 9 stations were part of the Macrometer network. The horizontal and vertical accuracy of the GPS survey is estimated to be 1 to 2 mm and 2 to 3 mm respectively. The horizontal accuracy of the terrestrial survey, consisting of angles and distances, equals that of the GPS survey only in the "loop" portion of the network. All stations are part of a precise level network. The ellipsoidal heights obtained from the GPS survey and the orthometric heights of the level network are used to compute geoid undulations. A geoid profile along

the linac was computed by the National Geodetic Survey in 1963. This profile agreed with the observed geoid within the standard deviation of the GPS survey. Angles and distances were adjusted together (TERRA), and all terrestrial observations were combined with the GPS vector observations in a combination adjustment (COMB). A comparison of COMB and TERRA revealed systematic errors in the terrestrial solution. A scale factor of 1.5 ppM +- .8 ppM was estimated. This value is of the same magnitude as the over-all horizontal accuracy of both networks. 10 refs., 3 figs., 5 tabs.

26005 **(SLAC-PUB—3655) SLC Program.** Prescott, C.Y. (Stanford Linear Accelerator Center, CA (USA)). Apr 1985. Contract AC03-76SF00515. 11p. (CONF-850278—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85011433.

From 5. topical workshop on proton-anti-proton collider physics; St. Vincent, Italy (25 Feb 1985).

A brief report on the status of the SLAC Linear Collider program is presented. Progress, current status, and anticipated schedules for machine components and experimental detectors are discussed.

26006 **Polarized internal target apparatus.** Holt, R.J. (to Dept. of Energy). US Patent Application 6-659,587. 10 Oct 1984. 19p. Contract W-31-109-ENG-38.

A polarized internal target apparatus with a polarized gas target of improved polarization and density (achieved by mixing target gas atoms with a small amount of alkali metal gas atoms, and passing a high intensity polarized light source into the mixture to cause the alkali metal gas atoms to become polarized which interact in spin exchange collisions with target gas atoms yielding polarized target gas atoms) is described.

26007 **Method for production of ceramic oxide and carbide bodies by polymer inclusion and decomposition.** Quinby, T.C. (to Dept. of Energy). US Patent Application 6-645,653. 30 Aug 1984. 18p. Contract AC05-84OR21400.

A method for the preparation of thin, free-standing metal oxide films which are useful as nuclear accelerator target materials is described. Cations of any metal except those of Group IA and precious metals, such as, U, Zr, Nd, Ce, Th, Pr or Cr, are absorbed on a thin film of polymeric material, such as carboxymethylcellulose, viscose rayon or cellophane. The cation impregnated polymeric material is dried. Then the impregnated film is heated in an inert atmosphere to form a carbonized membrane. The carbonized membrane is oxidized to yield a thin, self-supporting, metal oxide membrane. Or, the membrane can be heated in an inert atmosphere to yield a thin, self-supporting, metal carbide-containing membrane.

4304 Storage Rings

REFER ALSO TO CITATION(S) 25975

26008 **(ORNL-tr—5211) Experiments with stored heavy ions.** Fick, D.; Habs, D.; Jaeschke, E.; Knoepfle, K.T.; Kraemer, D.; Metag, V.; Neumann, R.; Povh, B.; Repnow, R.; Schuh, R. (Oak Ridge National Lab., TN (USA); Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)). Feb 1985. Contract AC05-84OR21400. Translation of MPI H-1985-V1. 49p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85009976.

The success of newly-developed methods of phase space cooling in proton and antiproton storage rings was sufficient for an examination of whether these methods could also be applied in storage rings for heavy ions. An expansion of these methods to heavy ion beams seems attractive for all sorts of reasons. Recently, this area was extensively discussed in a series of working meetings with the result that heavy ion storage rings are to be built for use in atomic and nuclear physics, with integrated radiation cooling and stochastic cooling, but primarily electron cooling. The current state of research and planning for the storage experiment is described. It is not intended to be a structural specification worked out in detail. The general design of the ring, however, has been established, and experimental details have deliberately been kept flexible, to thereby allow very different sorts of experiments to be conducted. The ring described with a maximum magnetic rigidity of Bp = 1.5 Tm, is designed in quadripartite symmetry. The total circumference is approximately 35 m, and there are four straight sections each 3.5 m long for the electron cooling sections, the experimental equipment, as well as HF system and injection. One of the most desirable properties of the reservoir is the multi-charge mode, which will significantly improve the operation which heavy ion beams, which reverse charge in electron cooling sections, target and residual vacuum. Initial considerations are presented with regard to stochastic and electron cooling. A review of possible classes of experiments is given and the schedule and financing of the project is outlined. 46 refs.

44 INSTRUMENTATION

4401 Radiation Instrumentation

REFER ALSO TO CITATION(S) 26003, 26431

26009 **(AD-A—150462/0/XAB) Effect of the choice or response matrix on unfolded Bonner sphere spectra. Memorandum report.** Lowry, K.A.; Johnson, T.L. (Naval Research Lab., Washington, DC (USA)). 31 Dec 1984. 49p. (NRL-MR—5493). NTIS, PC A03/MF A01.

The effect of the choice of response matrix on neutron spectra unfolded from Bonner sphere data was studied. In particular, the variation of integral parameters calculated from the unfolded spectra was determined for six matrices. It was determined that, depending on the choice of matrix, the calculated neutron fluence varies by approximately + or - 15%, the average neutron energy by + or - 40%, the dose by + or - 30%, the dose equivalent by up to a factor of 4, and the quality factor by + or - 35%. For personnel monitoring devices, the calculated response varied by up to a factor of 4 for the Navy albedo badge, a factor of 7 for a cadmium-covered albedo badge, a factor of 6 for a CR-39 dosimeter, and more than two orders of magnitude for NTA type emulsion film. Two of the response matrices gave results in good agreement with other calculated and experimental data.

26010 (DOE/ER/10275—1A, pp 1, Paper 2) **Main subdiagonal method in the design of a remote monitoring system.** Lopez-Montes-de-Oca, R.G. (Oregon State Univ., Corvallis). 1982. NTIS, PC A03/MF A01. File Number DE83004080. (CONF-820359—Absts.).

From Western regional American Nuclear Society student conference; Corvallis, OR, USA (28 Mar 1982).

The objective of this work is to develop a technique for determining the radioactivity released by nuclear facilities into the atmosphere at a remote location. This work resulted as a response to the Three Mile Island accident and treats the design of a system to continuously monitor the activity of the effluent released by nuclear power plants under normal and specially under accident conditions. The remote monitoring system is an important safety device useful for calculating the dose to the population and also for estimating the effects on the environment. Its use may also help to prevent the further release of radioactivity to the environment. A set of computer programs called ReMoS are written for a microcomputer (although it could also run on any high speed digital computer). These programs perform functions to calculate the activity released by nuclear power plants and also to compute gamma ray fluxes or detector count rates at a given location. The techniques used in ReMoS are the solution to an ill conditioned problem with a weak matrix diagonal (as discussed in more detail in the text).

26011 **(LA-UR—85-1299) Improvements in the energy resolution and high-count-rate performance of bismuth germanate.** Koehler, P.E.; Wender, S.A.; Kapustinsky, J.S. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 15p. (CONF-850533—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010763.

From 6. symposium on X- and gamma-ray sources and applications; Ann Arbor, MI, USA (21 May 1985).

Several methods for improving the energy resolution of bismuth germanate (BGO) have been investigated. It is shown that some of these methods resulted in a substantial improvement in the energy resolution. In addition, a method to improve the performance of BGO at high counting rates has been systematically studied. The results of this study are presented and discussed.

26012 (MRP/MRL—82-65) Technical evaluation of a radon daughter continuous monitor in an underground uranium mine. Bigu, J.; Grenier, M. (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada)). Jul 1982. 24p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700608.

An evaluation of a radon daughter monitor was carried out in an underground uranium mine. The monitor operates on continuous sampling and time integrating principles. Experimental and theoretical data were compared. Experimental results show that the monitor underestimates the Working Level, a fact which is partly attributed to plate-out of decay products in the monitor sampling head. However, a correction factor experimentally determined by standard calibration procedures can be programmed into the monitor to take into account losses by plate-out and other losses. Although the monitor was originally designed for radon daughters, it can equally be used in thoron daughter atmospheres and radon daughter/thoron daughter mixtures such as those encountered in some Canadian uranium mines. An analytical procedure is outlined to allow the calculation of Working Levels in radon daughter/thoron daughter atmospheres from the monitor α-count rate. The memory capability of the monitor should make it quite useful and flexible in underground and surface environments in the uranium mining industry.

26013 (MRP/MRL—82-79) Comparison of a continuous working level monitor for radon daughters with conventional grab-sampling. Bigu, J.; Grenier, M. (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada)). Aug 1982. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700609.

An evaluation of a radon daughter monitor was carried out under laboratory controlled conditions. The monitor operates on continuous sampling and time integrating principles and was tested in conjunction with a newly designed, large radon/thoron room calibration facility. The monitor was tested under constant and rapidly fluctuating radiation conditions. Experimental data obtained with the monitor were compared with data obtained by conventional grab-sampling and with an automated radon daughter/thoron daughter 'grab-sampler'. The Working Level used in the tests ranged from less than 0.01 WL to approximately 10 WL. The measurements were carried out under low aerosol concentration (1×10^3 - 2×10^3 cm^{-3}, approximately) to study plate-out effects in the sampling head. Good agreement (within about 10 %) was found between the monitor, conventional grab-sampling and the automated grab-sampler. The monitor should prove quite flexible, useful and reliable for monitoring underground and surface environments in the uranium mining industry.

26014 (PUC-TN—08/82) Superconducting microphone for photoacoustic spectroscopy. Ribeiro, P.C.; Labrunie, M.; Weid, J.P. von der; Symko, O.G. (Pontificia Univ. Catolica do Rio de Janeiro (Brazil). Dept. de Fisica). Jul 1982. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700610.

A superconducting microphone has been developed for photoacoustic spectroscopy at low temperatures. The microphone consists of a thin mylar membrane coated with a film of lead whose motion is detected by a SQUID magnetometer. For the simple setup presented here, the limiting pressure sensitivity is 7.5×10^{-14} atmospheres/$\sqrt{Hz}$.

26015 (RL—83-074) Conceptual design for a high resolution vertex detector for charm and beauty experiments using scintillating fibre optics. Atkinson, M.; Crennell, D.; Fisher, D.; Kurtz, N. (Rutherford Appleton Lab., Chilton (UK)). Aug 1983. 16p. (CONF-830718—33). NTIS (US Sales Only), PC A02/MF A01. File Number DE85700611.

From International Europhysics conference on high energy physics; Brighton, UK (20 Jul 1983).

The authors consider a detector, using scintillating optical fibres, designed to directly detect the production and decay vertices of charm and beauty particles. The aim is to provide a detector which can be used in a fixed target spectrometer to achieve sensitivities in the range 10 - 100 events per nanobarn. With a simple change in geometry the same technique should also allow the search for and study of heavy flavour production in a colliding beam machine and hence perhaps a route towards the Higgs particle. First the ideas for a fixed target detector are discussed and then the collider development.

26016 Apparatus and method for quantitative assay of generic transuranic wastes from nuclear reactors. Caldwell, J.T.; Atencio, J.D.; Kunz, W.E. (to Dept. of Energy). US Patent 4,483,816. 20 Nov 1984. Filed date 31 Mar 1982. vp.

PAT-APPL-363979.

A combination of passive and active neutron measurements which yields quantitative information about the isotopic composition of transuranic wastes from nuclear power or weapons material manufacture reactors is described. From the measurement of prompt and delayed neutron emission and the incidence of two coincidentally emitted neutrons from induced fission of fissile material in the sample, one can quantify ^{233}U, ^{235}U and ^{239}Pu isotopes in waste samples. Passive coincidence counting, including neutron multiplicity measurement and determination of the overall passive neutron flux additionally enables the separate quantitative evaluation of spontaneous fission isotopes such as ^{240}Pu, ^{244}Cm and ^{252}Cf, and the spontaneous alpha particle emitter ^{241}Am. These seven isotopes are the most important constituents of wastes from nuclear power reactors and once the mass of each isotope present is determined by the apparatus and method of the instant invention, the overall alpha particle activity can be determined to better than 1 nCi/g from known radioactivity data. Therefore, in addition to the quantitative analysis of the waste sample useful for later reclamation purposes, the alpha particle activity can be determined to decide whether "permanent" low-level burial is appropriate for the waste sample.

26017 Imaging radiation detector with gain. Morris, Ch.L.; Atencio, L.G.; Idzorek, G.C. (to Dept. of Energy). US Patent 4,479,059. 23 Oct 1984. Filed date 21 Jul 1982. vp.

PAT-APPL-400545.

A radiation imaging device which has application in x-ray imaging. The device can be utilized in CAT scanners and other devices which require high sensitivity and low x-ray fluxes. The device utilizes cumulative multiplication of charge carriers on the anode plane and the collection of positive ion charges to image the radiation intensity on the cathode plane. Parallel and orthogonal cathode wire arrays are disclosed as well as a two-dimensional grid pattern for collecting the positive ions on the cathode.

26018 Effect of tritium on accuracy of capacitance manometers: Summary abstract. Ellefson, R.E.; Gibbs, G.E.; Baker, R.W. (Monsanto Research Corp.- Mound, Miamisburg, OH). *Journal of Vacuum Science and Technology, A: Vacuum, Surfaces, and Films;* **1**: No. 2, 875-876(Apr-Jun 1983). Contract AC04-76DP00053;AC02-76CH03073.

Whenever tritium comes in contact with the electrical elements of a capacitance manometer, the accuracy of reading will be affected to varying degrees dependent on electrode geometry, signal conditioning, and quite possibly, the uniqueness of each head and electronics package. Currently, the most prudent use of capacitance manometers for differential tritium measurment would be a pair of SSTE-A heads matched for calibration and thermally coupled to coordinate drifts. Pressure difference unaffected by tritium concentration could then be determined by digital or analog difference. 5 references, 1 table.

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

REFER ALSO TO CITATION(S) 25440

26019 (AD-A—148386/6/XAB) Study in spurious sensitivity of electronics in space. Quarterly report No. 3, 1 April-30 June 1984. Yeager, D.M. (ITT Aerospace/Optical Div., Fort Wayne, IN (USA)). 26 Jun 1984. 5p. NTIS, PC A02/MF A01.

A measurement program in which a proton beam irradiates sensitive electro-optical sensors used in spacecraft systems has been prepared. The progress reported during this period includes device procurement, test setup, laboratory testing and accelerator test preparation.

26020 (LA-UR—85-1516) Fiber optics in transient radiation fields. Lyons, P.B. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 9p. (CONF-850345—16). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010721.

From Southwest conference on optics; Albuquerque, NM, USA (4 Mar 1985).

Fiber optics have been utilized in a variety of sensor and data transmission roles, some of which are complicated by the presence of ionizing radiation. In this paper, transient radiation effects in fibers are reviewed. Both luminescence and absorption processes are discussed in this paper, with emphasis on the latter subject. Most discussions are on effects occurring below 100 ns, with limited data in the microsecond time regime. This paper is intended as a review paper and its scope is restricted to previously published work. Areas that will profit from further study are highlighted.

26021 Pulsed irradiation of optimized, MBE grown, AlGaAs/GaAs radiation hardened photodiodes. Wiezer, J.J.; Barnes, C.E.; Dawson, L.R.; Fischer, T.A.; Osbourn, G.C.; Zipperian, T.E. (Sandia National Laboratories, Albuquerque, NM 87185). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-31**: No. 6, 1477-1482(Dec 1984).

An AlGaAs/GaAs double heterojunction, mesa isolated, photodiode grown by molecular beam epitaxy was irradiated with 18 MeV electrons, 1 - 10 MeV x-rays, and neutrons from a pulsed reactor. Test results indicate that the AlGaAs/GaAs photodiodes generate approximately 10 - 20 times less photocurrent during exposure to a pulse of ionizing-radiation than radiation hardened silicon PIN photodiodes. Studies of neutron induced permanent damage in the AlGaAs/GaAs photodiode show only small changes in optical responsivity and a factor of 8 increase in leakage currents after exposure to 3.6 x 10^{15} n/cm^2 and 900 krad gamma. The silicon PIN photodiode was exposed to only 28% of the fluence used on the AlGaAs photodiodes and we observed a 40% decrease in optical responsivity and a factor of 7000 increase in leakage current.

4403 Miscellaneous Instruments

REFER ALSO TO CITATION(S) 25853, 25927

26022 (CONF-8506113—1) Heat transfer monitor for measurements of fouling of industrial heat exchangers. Panchal, C.B. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 18p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010257.

From Symposium on condenser biofouling control; Lake Buena Vista, FL, USA (18 Jun 1985).

A Heat Transfer Monitor (HTM) is a sensitive device that quantifies development of fouling on heat exchanger surfaces in terms of degradation in the heat transfer coefficient as fouling progresses. The Argonne HTM was originally developed by Carnegie-Mellon University for Ocean Thermal Energy Conversion (OTEC) applications and later modified by Argonne National Laboratory. The HTM has been used for the OTEC biofouling and corrosion studies at the Natural Energy Laboratory of Hawaii for the last four years. The monitor has produced consistent results with an accuracy of about 0.0035 K m^2/kW (0.00002°F.h.ft^2/Btu). The major findings from the experimental investigation are: (a) periodic low level of 50 to 70 ppB of chlorination can remove and prevent biofouling, (b) biofouling for deep cold water is negligible, and (c) biofouling control methods for moderately enhanced surfaces are comparable to those for smooth surfaces.

26023 (EGG/10282—1057) Remote sensing technology: symposium proceedings. (EG and G Energy Measurements, Inc., Las Vegas, NV (USA)). Jan 1985. Contract AC08-83NV10282. 445p. (CONF-830286—). NTIS, PC A19/MF A01; 1; GPO Dep. File Number DE85010212.

From Symposium on remote sensing technology; Las Vegas, NV, USA (23 Feb 1983).

Papers were presented in four subject areas: applications of remote sensing; data analysis, digital and analog; acquisition systems; and general. Abstracts of individual items from the conference were prepared separately for the data base. (GHT)

26024 (LA-UR—85-733) Lidar techniques for search and rescue. Cabral, W.L. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 6p. (CONF-850345—10). NTIS, PC A02/MF A01; GPO Dep. File Number DE85009586.

From Southwest conference on optics; Albuquerque, NM, USA (4 Mar 1985).

Four techniques for using LIDAR in Search and Rescue Operations will be discussed. The topic will include laser retroreflection, laser-induced fluorescence in the visible, laser-induced fluorescence during daylight hours, and laser-induced fluorescence in the uv. These techniques use high-repetition rate lasers at a variety of frequencies to induce either fluorescence in dye markers or retroreflection from plastic corner cubes on life preservers and other emergency markers.

26025 (SAND—84-2436C) Gas sensing with surface acoustic wave devices. Martin, S.J.; Schweizer, K.S.; Ricco, A.J.; Zipperian, T.E. (Sandia National Labs., Albuquerque, NM (USA)). Mar 1985. Contract AC04-76DP00789. 9p. (CONF-850685—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85009125.

From 3. international conference on solid-state sensors and actuators; Philadelphia, PA, USA (12 Jun 1985).

The use of a ZnO-on-Si surface acoustic wave (SAW) resonator as a gas sensor is discussed. In particular, the sensitivity of the device to organic vapors is examined. The planar nature of the SAW device, in which the acoustic energy is confined to within roughly one acoustic wavelength of the surface, makes the device extremely sensitive to surface perturbations. This characteristic has been exploited in the construction of SAW gas sensors in which the surface wave propagation characteristics are altered by species adsorbed from the ambient gas. The porous nature of the sputtered ZnO film, in conjunction with the microbalance capability of the SAW device, gives the sensor the ability to distinguish molecules on the basis of both size and mass. (LEW)

26026 (SAND—85-0138C) Optical-fiber/microprocessor-based remote velocity sensor. Robertson, M.M.; Wolfe, J.P. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 7p. (CONF-850608—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010071.

From Spring conference on experimental mechanics; Las Vegas, NV, USA (9 Jun 1985).

A remote velocity sensor has been developed that uses both a fiber-optic system to monitor the position of an object and a microprocessor to track the object's position and calculate its average forward velocity between fiducial points (marks on a code plate). Sensing does not require electrical power at the sensing site, and the data are transmitted to the processing site by optical fibers whose inherent advantages include essential immunity to electromagnetic interference (EMI) and radio frequency interference (RFI). A feasibility model was designed, built, and evaluated that has a position resolution of 0.4 mm and is capable of calculating velocities up to 2.1 m/s with the particular code plate used.

26027 Electro-optical technique for intense microwave measurements. Chang, J.; Vittitoe, C.N.; Neyer, B.T.; Ballard, W.P. (Sandia National Laboratories, Post Office Box 5800, Albuquerque, New Mexico 87185). *Journal of Applied Physics;* **57**: No. 11, 4843-4848(1 Jun 1985).

An electro-optical technique has been developed to measure high-frequency electric fields in free space. Electrically induced birefringence in an electro-optical crystal is used to modulate a linearly polarized continuous-wave laser beam. The modulation impressed on the laser beam contains both frequency and field intensity information. A way to use this technique as both a frequency and power meter is discussed. A proof-of-principle experiment has been carried out with a 3.1-GHz magnetron source.

26028 Large facilities for condensed-matter science. Blume, M.; Moncton, D.E. (Brookhaen National Laboratory). *Physics Today;* **38**: No. 3, 68-78(Mar 1985).

Because they provide beams for many experiments simultaneously, intense neutron sources and synchrotron radiation sources are becoming exciting multidisciplinary research centers.

26029 Double resonator cantilever accelerometer. Koehler, D.R. (to Dept. of Energy). US Patent 4,479,385. 30 Oct 1984. Filed date 23 Sep 1982. vp.

PAT-APPL-422515.

A digital quartz accelerometer includes a pair of spaced double-ended tuning forks fastened at one end to a base and at the other end through a spacer mass. Transverse movement of the resonator members stresses one and compresses the other, providing a differential frequency output which is indicative of acceleration.

26030 Microprocessor controlled system for measuring wind speed profiles. Lorenz, R.; Woodward, W.J.; Murphy, C.E. Jr. (Savannah River Lab., Aiken, SC). *Analytical Instrumentation;* **13**: No. 2, 173-182(1984). Contract AC09-76SR00001.

A system utilizing a microcomputer, electronic scalers, sensitive cup anemometers and a specially designed interface was used to measure wind speed profiles above a loblolly pine plantation. The design, operation and results using this system are described. 5 references, 5 figures.

45 EXPLOSIONS AND EXPLOSIVES

REFER ALSO TO CITATION(S) 25862

4501 Chemical

26031 (LA-UR—85-1201) Effect of confinement on failure in 95 TATB/5 KEL-F. Ramsay, J.B. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 7p. (CONF-850706—17). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010790.

From 8. international symposium on detonation; Albuquerque, NM, USA (15 Jul 1985).

A modification of the usual wedge test for measuring the failure thickness has been developed that eliminates the effect of the confinement provided by the witness plate. The new test uses a prism of the explosive with a line initiator to start a detonation along the trapezoidal face of the prism. Experiments using PBX 9502 have shown that the failure thickness measured using the prism test is 1/2 the failure diameter measured in long cyclindrical charges, provided the wave can propagate 15 to 25 times the failure width. No significant effects of confinement is observed for low impedance confinement, whereas high impedance materials reduce the failure thickness. Thin layers of confinement reduce the failure thickness significantly. Copper, 0.025 mm thick, and 0.25-mm aluminum each reduce the failure thickness of PBX 9502 by 35%. 6 refs., 7 figs.

26032 (MLM—3236(OP)) Compatibility, contamination and ir microspectrophotometry. Carlson, R.S. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 1985. Contract AC04-76DP00053. 5p. (CONF-8503100—4). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010809.

From ADPA meeting; Hilton Head, SC, USA (11 Mar 1985).

Infrared microspectrophotometry, a new technique in DOE, has been successfully employed in the resolution of several contamination problems involving energetic materials. Foreign particles as small as 10 x 10 μm in B/KNO_3 powder, LX-16 (plastic-bonded PETN) pellets, and on the MSAD (mechanical safe and arm detonator) were examined and identified. The presence of boric acid crystals on B/KNO_3 pellets was discovered, and compatibility problems involving MSAD and an experimental detonator were investigated. This instrument gives Mound a unique problem solving and investigative capability. 1 fig.

26033 (MLM—3239(OP)) Burn rates of explosives at high pressures. Holy, J.A. (Monsanto Research Corp., Miamisburg, OH (USA)). 1985. Contract AC04-76DP00053. 4p. (CONF-8503100—7). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010806.

From ADPA meeting; Hilton Head, SC, USA (11 Mar 1985).

The burn rates of PETN, HMX, PBX-9404, PBX-9501, and PBX-9502 in inert gases have been determined as a function of pressure to 340 MPa by a closed bomb technique. The burn rates were fit to the de St.-Robert equation R = aP/sup n/. An abrupt transition to a higher rate of pressure increase generated by the burning sample occurs as the initial inert gas pressure is raised. In the porous beds of PETN and HMX, the rate change may be due to a transition from conductive to convective burning, an intermediate step in the deflagration-to-detonation transition. The rate change is probably due to a sample deconsolidation in the PBX-9404 and PBX-9501 sticks. It is also found that there is a minimum pressure below which deflagration cannot be sustained. 11 refs., 4 figs., 1 tab.

26034 (MLM—3240(OP)) Thermal expansion coefficients of a 30% glass fiber filled PEEK pyrotechnic charge holder. Donnelly, M.W.; Walters, R.R.; Miller, G.D. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 1985. Contract AC04-76DP00053. 4p. (CONF-8503100—5). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010805.

From ADPA meeting; Hilton Head, SC, USA (11 Mar 1985).

Pyrotechnic actuators use hollow cylindrical ceramic or plastic charge holders to electrically isolate the pyrotechnic charge from the actuator case. In a newly developed actuator, 30% glass fiber filled polyetheretherketone (PEEK) was selected as the charge holder material both for its strength and its forming properties. Because the actuators are exposed to significant temperature variations during storage and flight, a determination of the coefficient of thermal expansion, α, of the charge holders was required to assure success in this, the first electroexplosive device application of PEEK. Of special interest in this project were the questions of whether α depends on the direction (with respect to flow in the mold) or on injection pressure. From the test results, the conclusions are: (1) α does depend on direction. Its value in the thickness direction is approximately twice that in either the height or circumferential direction. This is probably because the wall thickness, 0.015", is less than the average fiber length, 0.100",-and the PEEK is, therefore, not acting as a composite in the t direction. (2) Varying the injection pressure over the range of this study has no detectable effect on α. This charge holder is molded into an Inconel actuator case with α = 11.4 μm/m.C. This relatively close match of α's between adjacent materials has resulted in no dimensional problems during manufacturing and environmental testing. 1 fig., 1 tab.

26035 (MLM—3241(OP)) X-ray Photoelectron Spectroscopy study of the compatibility of the explosive PETN with candidate plastic bonding materials. Vannet, M.D.; Wang, P.S.; Moddeman, W.E.; Bowling, W.C. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 1985. Contract AC04-76DP00053. 5p. (CONF-8503100—8). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010804.

From ADPA meeting; Hilton Head, SC, USA (11 Mar 1985).

The compatibility of the explosive PETN with two plastic bonding materials, ethyl cellulose and a halogenated vinyl polymer (FPC 461), was determined by X-ray Photoelectron Spectroscopy (XPS). Both were found to coat the PETN crystals, and no change in chemical composition was found in the PETN or the plastic due to either the process or their mutual presence. 3 refs., 1 fig., 1 tab.

26036 **(SAND—85-0361) CP DDT detonators: IV. Thermal aging.** Lieberman, L.; Durand, N.A. (Sandia National Labs., Albuquerque, NM (USA)). Apr 1985. Contract AC04-76DP00789. 23p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85011172.

Detonators loaded with the explosive CP were thermally aged at 140 to 180°C to determine the upper temperature limit which the devices could withstand and still provide satisfactory functional characteristics. Little, if any, degradation was found after aging at 140°C, but unsatisfactory function was obtained after aging at 180°C. The data clearly establish that 180°C exceeds the useful limit for CP detonators. Data obtained after heating at 160°C suggest reliability may be diminished from such a thermal treatment. As a result, we conclude that the upper temperature limit for CP detonators heated for a two-week period is in the range 140 to 160°C. 8 refs.

26037 **(SAND—85-0708) SCAP - a Shaped Charge Analysis Program: user's manual for SCAP 1.0.** Robinson, A.C. (Sandia National Labs., Albuquerque, NM (USA)). Apr 1985. Contract AC04-76DP00789. 83p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85011182.

The basic modeling and format for a shaped charge analysis program, SCAP, is described. The code models the motion of liner elements due to explosive loading, jet formation, jet breakup and target penetration through application of a series of analytical approximations. The structure of the code is intended to provide flexibility in shaped charge device and target configurations and in modeling techniques. The code is designed for interactive use and produces both printed and plotted output. Examples of code output are given and compared with experimental data. 19 refs., 13 figs.

26038 **Shock initiation, detonation wave propagation and metal acceleration measurements and calculations for RX-26-AF.** Tarver, C.M.; Erickson, L.M.; Parker, N.L. (Lawrence Livermore National Lab., CA). pp 609-612 of Shock waves in condensed matter - 1983. Asay, J.R.; Graham, R.A.; Straub, G.K. (eds.). New York, NY; Elsevier Science Publishers B.V. (1984). Contract W-7405-ENG-48.

Embedded pressure and particle velocity gauge records of shock initiation and detonation wave propagation in the heterogeneous solid explosive mixture RX-26-AF are shown to be accurately calculated by an ignition and growth reactive flow model that separates the growth reaction rates into those of the individual explosives HMX and TATB. Fabry-Perot measurements of the free surface velocity histories of tantalum plates driven by detonating RX-26-AF are also compared to model predictions.

26039 **Detonation product EOS: the region above Chapman-Jouguet pressure.** Lee, E.L.; Van Thiel, M.; Green, L.G.; Mitchell, A. (Lawrence Livermore National Lab., CA). pp 817-620 of Shock waves in condensed matter - 1983. Asay, J.R.; Graham, R.A.; Straub, G.K. (eds.). New York, NY; Elsevier Science Publishers B.V. (1984). Contract W-7405-ENG-48.

Examination of results from overdriven detonation experiments performed at our laboratory and from earlier work has led us to question current models for detonation and for high pressure equations of state. The experimental evidence shows abruptly increasing shock velocities at shock strengths above Chapman-Jouguet pressure. These results place severe constraints on both the detonation hydrodynamics and the equation of state of the products. A change in the detonation model would require C-J pressures lower than the normally accepted values or a relaxation of sonic conditions at C-J. Alternatively an unusually large dependence of Gamma = (δlnP/δlnV)/sub S/ on V is required in the equation of state of the products.

26040 **Reactive flow Lagrange analysis in RX-26-AF.** Nutt, G.L.; Erickson, L.M. (Lawrence Livermore National Lab., CA). pp 605-608 of Shock waves in condensed matter - 1983. Asay, J.R.; Graham, R.A.; Straub, G.K. (eds.). New York, NY; Elsevier Science Publishers B.V. (1984). Contract W-7405-ENG-48.

A series of Lagrange gauge records, taken in RX-26-AF are analyzed. The explosive is initiated at 27 Kb sustained shock pressure. The resulting reaction runs through approximately 1.5 cm of the PBX, while pressure and velocity measurements are taken at various Lagrange coordinates. Using the equation of state for reactant, and product gases, in the J.W.L. form, a reactive flow Lagrange analysis (RFLA) is used to calculate the reaction progress coordinate. The results show an interesting two-stage reaction possibly associated with the different reaction rates of HMX and TATB. Problems with consistency and error are discussed.

26041 **Three-dimensional modeling of inert metal-loaded explosives.** Mader, C.L.; Kershner, J.D.; Pimbley, G.H. (Los Alamos National Lab., NM). *Journal of Energetic Materials;* 1: 293-324(Dec 1983).

The reactive three-dimensional hydrodynamic code 3DE was used to investigate the reactive hydrodynamics of a matrix of tungsten particles in HMX. A propagating detonation proceeding through the matrix of tungsten particles gives calculated detonation velocities and pressures that are much higher than observed. If the heterogeneous shock-initiation Forest Fire rate for HMX is used to describe the reactive kinetics, some of the individual detonation wavelets between the tungsten particles fail. The shocked explosive continues to decompose and release energy after shock passage. Equations of state are described for a tungsten and a lead-loaded explosive that reproduce the observed performance of these nonideal explosives. The calibrated equations of state use a partial energy release suggested by the three-dimensional model. Evidence is presented that the explosives have a flat-top Taylor wave characteristic of weak detonations. 10 references, 14 figures.

4502 Nuclear

REFER ALSO TO CITATION(S) 26243

26042 **(AD—345252/1/XAB) Fallout sampling and analysis: radiation dose rate and dose history at 16 locations.** Clark, D.E.; Kawahara, F.K.; Cobbin, W.C. (Naval Radiological Defense Lab., San Francisco, CA (USA)). 24 Oct 1963. 127p. NTIS, PC A07/MF A01.

Report on Operation Sun Beam Shot Johnie Boy, Project 2 9.

The objectives were: (1) to obtain quantitative collections of fallout to determine mass per unit area, ionization decay rates, and size activity relationships; (2) to compare radiochemical, chemical, and physical properties of environmental surface material and fallout material; and (3) to measure, during fallout, the radiation dose rate and accumulated integrated dose with time without discriminating among initial, transit, and deposited radiation sources. All 16 of the stations in the array received measurable amounts of fallout. Quantitative measurements of fallout mass per unit area, ionization decay, and size-activity relationships are tabulated for most of the stations. Radiochemical analyses of 46 samples for as many as 13 radionuclides are tabulated and indicate the expected amount of fractionation for the type of weapon used.

26043 **(AD-A—149844/3/XAB) Merging of non-concentric fireballs. Technical report.** Cosner, K. (Mission Research Corp., Santa Barbara, CA (USA)). 1 Dec 1983. 79p. (MRC-R—806). NTIS, PC A05/MF A01.

The MICE radiation hydrodynamics code was used to study low-altitude multiple non-concentric megaton bursts to study effects dependent upon burst separation.

26044 (AD-A—149986/2/XAB) Material properties of Nevada Test Site tuff relating to the Diablo Hawk Structures experiments and containment evaluation. Final report, 1 September 1977-31 August 1978. Gardiner, D.S.; Jones, A.H.; Butters, S.W. (Terra Tek, Inc., Salt Lake City, UT (USA)). 1 Nov 1978. 224p. (TR—78-78). NTIS, PC A10/MF A01.

Material properties testing has been conducted for the Defense Nuclear Agency Field Command. Testing was in support of the Nevada Test Site nuclear test program and covered the period 1 October 1977 through 31 August 1978. The contract number was DNA001-77-C-0322 and Mr. J.W. LaComb was the Contracting Officer Representative. The primary task during this report period was material evaluation for the Diablo Hawk Structures experiments and the on-going containment evaluation study. Tuff, grout, saturated sand and reconstituted tuff were tested. The material evaluations are used for initial nuclear test site selection, detailed site evaluation, shock effect evaluation and support of related experiments. The majority of the tests were uniaxial strain tests with accompanying physical property and ultrasonic velocity measurements. Additionally, hydrostatic and triaxial compression, bursts, permeability and scanning electron microscope tests were conducted.

26045 (AD-A—150620/3/XAB) Geotechnical assessment of United States and foreign test sites and material properties of geologic media. Final report. Pratt, H.R.; Swolfs, H.S.; Butters, S.W.; Gardiner, D. (Terra Tek, Inc., Salt Lake City, UT (USA)). Jun 1979. 70p. NTIS, PC A04/MF A01.

This report includes a compilation of both physical and mechanical property data for use in developing in-situ constitutive relations. The in-situ stress state is defined for a variety of rock types and structural environments. Triaxial tests, including hydrostatic and uniaxial strain tests, were conducted on sandstone and shale from the GASBUGGY site. Problems studied include the intact versus residual failure envelopes, dilatant behavior and the dependency of modulus on strain-rate. Salt cores from both the GNOME event and SALMON event were tested under triaxial conditions; both compression and extension failure enveloped were determined.

26046 (ORNL/TM—9439) Sulfur activation at the Little Boy-Comet Critical Assembly: a replica of the Hiroshima bomb. Kerr, G.D.; Emery, J.F.; Pace, J.V. III. (Oak Ridge National Lab., TN (USA)). Apr 1985. Contract AC05-84OR21400. 30p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85010261.

Studies have been completed on the activation of sulfur by fast neutrons from the Little Boy-Comet Critical Assembly which replicates the general features of the Hiroshima bomb. The complex effects of the bomb's design and construction on leakage of sulfur-activation neutrons were investigated both experimentally and theoretically. Our sulfur activation studies were performed as part of a larger program to provide benchmark data for testing of methods used in recent source-term calculations for the Hiroshima bomb. Source neutrons capable of activating sulfur play an important role in determining neutron doses in Hiroshima at a kilometer or more from the point of explosion. 37 refs., 5 figs., 6 tabs.

26047 (UCID—20393) Evaluation of the utility of a large-spacing dipole-dipole borehole logging tool. Sweeney, J.; Harben, P. (Lawrence Livermore National Lab., CA (USA)). 1 Apr 1985. Contract W-7405-ENG-48. 42p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85010408.

The paper reports a theoretical analysis of the potential of downhole dipole-dipole measurements to detect anomalous montmorillonite zones in the far-field of a borehole. First, simple geometries are analyzed and then various interpretation schemes are evaluated based on simulation of field measurements. Finally, an assessment of the value of the proposed borehole tool is made in terms of usefulness to containment evaluation. 6 refs., 19 figs. (ACR)

26048 (UCRL—91639) Blast induced subsidence in the craters of nuclear tests over coral. Burton, D.E.; Swift, R.P.; Glenn, H.D.; Bryan, J.B. (Lawrence Livermore National Lab., CA (USA)). Feb 1985. Contract W-7405-ENG-48. 9p. (CONF-850671—4). NTIS, PC A02/MF A01; GPO Dep. File Number DE85007975.

From 26. U.S. symposium on rock mechanics; Rapid City, SD, USA (26 Jun 1985).

The craters from high-yield nuclear tests at the Pacific Proving Grounds are very broad and shallow in comparison with the bowl-shaped craters formed in continental rock at the Nevada Test Site and elsewhere. Attempts to account for the differences quantitatively have been generally unsatisfactory. We have for the first time successfully modeled the Koa Event, a representative coral-atoll test. On the basis of plausible assumptions about the geology and about the constitutive relations for coral, we have shown that the size and shape of the Koa crater can be accounted for by subsidence and liquefaction phenomena. If future studies confirm these assumptions, it will mean that some scaling formulas based on data from the Pacific will have to be revised to avoid overestimating weapons effects in continental geology. 9 refs., 5 figs.

26049 Numerical methods developed for the simulation of coupled high-energy gas flows and stress wave propagation in geologic media. Killian, B.G. (Los Alamos National Lab., NM). pp 505-508 of Shock waves in condensed matter - 1983. Asay, J.R.; Graham, R.A.; Straub, G.K. (eds.). New York, NY; Elsevier Science Publishers B.V. (1984).

This paper summarizes work performed to address the generic question: if an opening extends from a nuclear explosive that is emplaced underground, will energy be preferentially channeled into this opening, or will ground shock close the hole? The numerical models developed to address this question and the comparison of those models with data obtained from shock tube experiments are presented. The results indicate that: (1) the numerical models developed are capable of simulating shock tube flows ranging from conventional low-energy shock tubes through nuclear shock tubes, and (2) significant energy can be preferentially channeled into an opening that extends outward from the original energy source.

4503 Explosion Detection

26050 (AD-A—150142/8/XAB) Lg wave excitation and propagation with application to nuclear yield determination. Semi-annual report No. 3, 1 April-31 October 1984. Herrmann, R.B.; Wang, C.Y. (Saint Louis Univ., MO (USA). Dept. of Earth and Atmospheric Sciences). 27 Nov 1984. 99p. NTIS, PC A05/MF A01.

Studies of seismic wave propagation in heterogeneous media are continued. A detailed study of the Cerveny-Psencik ray tracing program SEIS81 is made by comparing results to those obtained by full wavenumber integration and Cagniard-de Hoop techniques. Programming errors were detected in the subroutines AMPL and COEF8 which led to incorrect amplitudes of free-surface reflections of shear waves. These errors are present in SEIS83 and in other programs which uses these routines. The other result obtained consists of initial formulation and testing of algorithms for deterministic scattering of surface waves by point scatterers. Initial results are promising, yielding qualitative agreement with obeerved data. First-order scattering theory can be made to fit onto small minicomputers. Initial results point out the importance of the source-scatterer-receiver distance, mode conversion and wavetype conversion.

26051 (AD-A—150198/0/XAB) Attenuation of seismic waves at regional distances. Final technical report, 1 October 1982-30 September 1984. Nuttli, O.W.; Mitchell, B.J. (Saint Louis Univ., MO (USA). Dept. of Earth and Atmospheric Sciences). 27 Nov 1984. 132p. NTIS, PC A07/MF A01.

The coda-Q method was applied to determine the anelastic attenuation of 1-sec period Lg waves at NTS(Nevada Test Site), East Kazakh, the Indian subcontinent, and the South American continent. Mb(Lg) m sub b (Lg) versus explosion yield calibration curves are given for NTS explosions in hard rock and in alluvium. The NTS hard-rock calibration curve, when applied to explosions in other regions of the United States and in the French Sahara, gives realistic yield estimates. The technique also is applied to selected Soviet explosions in East Kazakh. M sub b (Lg) and M sub b (P) values were used to estimate the M sub b (P) bias between NTS and eastern North America. Assuming that explosions and earthquakes of the same M sub b (P) value excite Lg waves of equal

amplitude, the P-wave magnitude bias between NTS and eastern North America. Assuming that explosions and earthquakes of the same M sub b (P) value excite Lg waves of equal amplitude, the P-wave magnitude bias between NTS and eastern North America is 0.31 magnitude units. A tentative value for the bias between NTS and Shagan River is 0.41 magnitude units, but this value may be changed. Frequency-dependence of crustal Q seems significant in regions of high Q, but are small or non-existent in regions of low Q values.

26052 (AD-A—150801/9/XAB) Regional seismic-wave propagation. Final technical report, 1 October 1982-30 September 1984. Carter, J.A.; Peseckis, L.L.; Pomeroy, P.W.; Sutton, G.H. (Rondout Associates, Inc., Stone Ridge, NY (USA)). 30 Nov 1984. 254p. NTIS, PC A12/MF A01.

Work has involved evaluation of method for using regional seismic waves, particularly Lg for yield determination. The Wake Island Hydrophone Array digital recording continues to provide high-quality data. Polarization and array analyses have been made of Catskill Seismic Array and Regional Seismic Test Network data. For continental models, whole waveform synthetics demonstrate clearly the large dependence of the amplitude and spectral shape on the focal depth and the smaller dependence of these factors on focal mechanism. The broadband digital seismic station, SRNY has been in operation since 16 May 1984. Digital data are recorded magnetic cartridge tapes each capable of holding 67 Megabytes or 38 hours of data. Many programs have been developed for data handling and analysis.

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

5001 Basic Studies

REFER ALSO TO CITATION(S) 25166, 26060, 26073

26053 (DOE/ER/60081—T1) Examination of the time and spatial scales appropriate for the carbon dioxide climate change issue. Final report. Shieh, S.J. (InterAmerica Research Associates, Inc., Rosslyn, VA). 29 Jun 1984. Contract AC01-82ER60081. 25p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85009852.

There are five dimensions to be considered in the study or prediction of weather or climate: longitude, latitude, altitude, time and the weather or climate attributes of concern. Longitude, latitude and altitude define the space where weather/climate events take place. Time plays a multifunctional role, being the basis for determining the variables to be collected, the data desired, physical laws of relevance, and time steps of integration. This paper is an attempt to theoretically sort out the sections in the time continuum from minutes to many years and in the spatial continuum from a few kilometers to hundreds of kilometers, that are relevant to the issue of CO_2-induced climate change. 19 refs. (ACR)

26054 (GSF-BPT—10/84) Kinetics and intensity of photochemical processes in the atmosphere. Marx, W.; Monkhouse, P.B.; Schurath, U. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Bereich Projekttraegerschaften). Jun 1984. 91p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE85751615.

Field measurements of the photolysis frequencies of aldehydes under cloud-free conditions have been carried out by suitable methods, in order to deduce the zenith angle dependencies. Photolysis frequencies are comparable in importance to reaction rate constants in chemical models of the atmosphere, but are dependent on the light intensity and spectral distribution, making photolysis frequency calculations quite difficult on the basis of laboratory data only. The pressure dependencies of several dissociation pathways (formation of radicals or stable molecular products) were investigated both under laboratory and field conditions. The photolysis frequencies of nitrogen dioxide and methyl nitrite were measured with high precision under specified field conditions. Combining all the available data zenith angle dependencies of 8 important photochemical processes at ground level could be cast in simple parameter form. The results, summarized in figure 28 and table 5, are suited for calculating photolysis frequencies in chemical models as function of zenith angle, for $z < 70^{\circ}$.

26055 (IFUSP-P—416) Trace elements in the urban aerosol of Sao Paulo. Orsini, C.M.Q.; Artaxo Netto, P.E.; Tabacniks, M.H. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Jul 1983. 9p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700594.

The first trace-element data-set measured on the atmosphere aerosol of Sao Paulo City, Brazil, is presented. These measurements have been based on samplings by 6-stage cascade impactors combined with the analytical procedure by the PIXE method of elementary analysis.

26056 (IFUSP-P—417) Sao Paulo - PIXE system and its use on a national monitoring air quality program. Orsini, C.M.Q.; Artaxo Netto, P.E.; Tabacniks, M.H. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Jul 1983. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700595.

The SP-PIXE has been installed on the 8 MV Pelletron accelerator of the IFUSP. Its characteristics and calibration procedure are presented below. The SP-PIXE is being used as the reference analytical method on a national monitoring air quality program performed by the Group for Air Pollution Studies (GEPA) of the IFUSP. As part of the program eight sites around Brazil, seven having critical air pollution problems and one with natural atmosphere, have been selected for sampling. Each aerosol is sampled continuously for one year using stacked filter units and, for period of 3 to 5 days, by 10-stage cascade impactors. Partial results from the first two sites investigated are presented here by figures of element size distribution curves and histograms of relative concentrations.

26057 (LA-UR—85-963) Wind and saltation driven particle resuspension in a wind tunnel. Fairchild, C.I.; Tillery, M.I.; Wheat, L.D.; Redmond, D.J. (Los Alamos National Lab., NM (USA); Hewlett-Packard Co., Los Alamos, NM (USA)). 1985. Contract W-7405-ENG-36. 6p. (CONF-850406—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85009632.

From International symposium and workshop on particulate and multi-phase processes and the 16th annual meeting of the Fine Particle Society; Miami Beach, FL, USA (22 Apr 1985).

To determine parameters of primary importance in wind and saltation driven resuspension of fine particles from surfaces, wind tunnel experiments were conducted to study the resuspension of small polydisperse particles (diameter <10 μm) by monodisperse saltation particles (diameter >80 μm). The experiments were designed to simulate the atmospheric boundary layer resuspension of fine particles. 3 refs., 1 tab.

26058 (PB—85-160208/XAB) Estimation of extreme wind gusts from inadequate data. Technical paper. Louw, W.J.; Katsiambirtas, E. (Weather Bureau, Pretoria (South Africa)). 1974. 26p. NTIS, PC E04/MF E01.

See also PB85-160232.

The economic value of meteorological information to many weather-sensitive sectors of the economy has been established indisputably. However, to derive the maximum benefit from the use of weather data it is essential that such information be made available in the most useful form. Diversification of interest and enterprise therefore implies that meteorological parameters be presented in a variety of processed forms to suit the specialized needs of individual users. In the design and construction of high buildings, stack and power lines there is specific interest not only in the established values of maximum winds but also in the peak gusts which can be expected in future.

26059 (UCID—20414) Categorization of nocturnal drainage flows within the Brush Creek valley in western Colorado and the variability of sigma theta in complex terrain. Gudiksen, P.H. (Lawrence Livermore National Lab., CA (USA)). Mar 1985. Contract W-7405-ENG-48. 20p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85011291.

The monthly frequencies of nocturnal drainage flows in the Brush Creek valley were estimated over the period August 1982 to January 1985 for the purpose of evaluating the representativeness of the drainage flows observed during a few intensive study periods. These estimates were made on the basis of data from three short meteorological towers situated in the valley. The highest frequencies were observed during the June to October timeframes: 30 to 40% during 1983 and 10 to 30% during 1984. Of the ten experimental nights when intensive investigations were conducted within the Brush Creek valley, seven were during strong drainage flow periods and three were during weaker drainage flow periods. The variability of $\sigma\ \theta$ in complex terrain areas was investigated since this parameter is often used to estimate diffusion of pollutants. Measurements made during strong drainage flow periods within two valleys in The Geysers geothermal area in northern California and within the Brush Creek valley yielded hourly-averaged values that varied from a few degrees to a little over one hundred degrees at each measurement site. The median values typically ranged from 15° to 40°. Generally, the highest values were acquired at measurement sites situated on the valley floor; the lowest values on the ridges; and intermediate values along the slopes. This ordering may be due to the winds generally being stronger over the ridges than within the valley, since there is weak evidence for an inverse relationship between the median wind speeds and $\sigma\ \theta$ values, even though this relationship was not in evidence between the individual measurements. 3 refs., 9 figs., 2 tabs.

5002 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 25168, 25169, 25170, 25173, 25175, 25237, 25240, 25520, 25521, 25740, 25741, 25742, 25875, 26023, 26053, 26054, 26085, 26096, 26103, 26128

26060 (ATDL—84/32) Environmental Research Laboratories 1983 annual report. (National Oceanic and Atmospheric Administration, Oak Ridge, TN (USA). Atmospheric Turbulence and Diffusion Lab.). 1984. 32p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85001798.

This document contains abstracts of research contributions from the Atmospheric Turbulence and Diffusion Division during 1983. Areas studied include: plume transport and dispersion, atmospheric studies in complex terrain, forest meteorology and dry deposition monitoring research.

26061 (CONF-850406—4) Effects of relative humidity gradients on the evaluation of submicron aerosol flux measurements in the atmospheric surface layer. DePaul, F.T.; Sisterson, D.L.; Wesely, M.L. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010510.

From International symposium and workshop on particulate and multi-phase processes and the 16th annual meeting of the Fine Particle Society; Miami Beach, FL, USA (22 Apr 1985).

This study investigates the influence of humidity gradients on submicron particle fluxes and the resulting deposition velocities estimated from a micrometeorological, aerodynamic technique. The effects of relative humidity causing condensational growth and evaporative shrinkage of submicron particles and then significantly altering deposition velocities, estimated by applying an aerodynamic computational scheme to values of particle concentrations measured at heights of 1.0 and 8.5 m above a grass surface, appear negligible when relative humidities at the measurement heights are less than 98%. Also, the effects of surface wetness to increase the deposition velocities appear insignificant. Deposition velocities for the larger size cut are rarely significantly different from zero. The very fine particles have deposition velocities that are positive most of the time, and peak during the afternoon. 12 refs., 3 tabs.

26062 (CONF-850612—3) Qualitative and quantitative examination of the performance of regional air quality models representing different modeling approaches. Bhumralkar, C.M.; Ludwig, F.L.; Shannon, J.D.; McNaughton, D. (SRI International, Menlo Park, CA (USA). Atmospheric Science Center; Argonne National Lab., IL (USA); TRC Environmental Consultants, Inc., East Hartford, CT (USA)). Apr 1985. Contract W-31-109-ENG-38. 21p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010508.

From Air Pollution Control Association annual meeting and exhibition; Detroit, MI, USA (16 Jun 1985).

The calculations of three different air quality models were compared with the best available observations. The comparisons were made without calibrating the models to improve agreement with the observations. Model performance was poor for short averaging times (less than 24 hours). Some of the poor performance can be traced to errors in the input meteorological fields, but error exist on all levels. It should be noted that these models were not originally designed for treating short-term episodes. For short-term episodes, much of the variance in the data can arise from small spatial scale features that tend to be averaged out over longer periods. These small spatial scale features cannot be resolved with the coarse grids that are used for the meteorological and emissions inputs. Thus, it is not surprising that the models performed for the longer averaging times. The models compared were RTM-II, ENAMAP-2 and ACID. (17 refs., 5 figs., 4 tabs.

26063 (DOE/CH/00016—T5) Comparison of the perfluorocarbon and tracer gas decay methods for assessing infiltration rates in residents. Schaap, L.; Leaderer, B.P.; Renes, S.; Verstraelen, H.; Tosun, T.; Dietz, R.N. (Brookhaven National Lab., Upton, NY (USA)). 1985. Contract AC02-76CH00016. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010385.

The passive perfluorocarbon tracer (PFT) technique for determining air infiltration rates into homes and buildings was evaluated in an environmental chamber. The impact of sampler orientation at a constant ventilation rate and a constant temperature, of variable ventilation rate at a constant temperature, and of variable temperature at a constant ventilation rate were evaluated. The average relative standard deviation of 16 paired samplers deployed in experiment 1 was +- 1.9% +- 1.0% indicating good reproducibility of the passive sampling rate and sample analysis. No impact of sampler orientation with respect to low air velocities (<0.2 m/s) present in houses is expected. The passive samplers accurately measured the average tracer concentration as compared with calculations based on the known source strength (CO_2 decays) and the measured ventilation rate under conditions of a 3-fold variation in ventilation rates (experiment 2). Temperature cycling differences of 8°C (experiment 3) did not produce a bias in the PFT determined ventilation rate. The PFT technique is applicable to the expected range of condition in homes and buildings. 3 refs., 1 fig., 1 tab.

26064 (EPRI-EA/EM—3824, pp 1.1-1.9) Overview: indoor air quality as an issue for electric utilities. Harper, J.P. (Tennessee Valley Authority, Chattanooga). Jan 1985. Research Reports Center, Box 50490, Palo Alto, CA 94303 $23.50. File Number TI85920206. (CONF-8403172—; CONF-8405169—).

From Indoor air quality seminar - implications for electric utility conservation programs; Atlanta, GA, USA (6 Mar 1984).

The topic of indoor air pollution is examined historically and it's evolution into a major issue today is traced. Interrelationships between energy conservation measures and indoor air quality which electric utility managers have to be aware of and plan for are discussed.

26065 (EPRI-EA/EM—3824, pp 2.1-2.9) Indoor air quality: a utility perspective. Scott, E. (Pacific Gas and Electric, San Francisco, CA). Jan 1985. Research Reports Center, Box 50490, Palo Alto, CA 94303 $23.50. File Number TI85920206. (CONF-8403172—; CONF-8405169—).

From Indoor air quality seminar - implications for electric utility conservation programs; Atlanta, GA, USA (6 Mar 1984).

The complexity of the indoor air quality issue for electric utilities is discussed. Pacific Gas and Electric's approach to the problem is reviewed.

26066 (EPRI-EA/EM—3824, pp 4.1-4.8) **Indoor air pollution: an introduction to the EPRI manual.** Grimsrud, D.T.; Diamond, R.C. (Lawrence Berkeley Lab., CA). Jan 1985. Research Reports Center, Box 50490, Palo Alto, CA 94303 $23.50. File Number TI85920206. (CONF-8403172—; CONF-8405169—). Contract AC03-76SF00098.

From Indoor air quality seminar - implications for electric utility conservation programs; Atlanta, GA, USA (6 Mar 1984).

Indoor air quality concerns, major pollutant sources, measurement techniques, and control techniques are discussed and the utility of the manual as a reference guide for these subjects is suggested.

26067 (EPRI-EA/EM—3824, pp 8.1-8.7) **Formaldehyde: an important indoor pollutant.** Hawthorne, A.R.; Matthews, T.G. (Oak Ridge National Lab., TN). Jan 1985. Research Reports Center, Box 50490, Palo Alto, CA 94303 $23.50. File Number TI85920206. (CONF-8403172—; CONF-8405169—). Contract AC05-84OR21400.

From Indoor air quality seminar - implications for electric utility conservation programs; Atlanta, GA, USA (6 Mar 1984).

Formaldehyde is near the top of most lists of important indoor pollutants. Concern over exposure to formaldehyde in the indoor environment has substantially increased during the previous five years. Formaldehyde is pervasive in today's economy. In 1981, formaldehyde was 24th among bulk chemicals produced in the US and is used in a wide variety of products. This short review highlights the important issues relating to formaldehyde and indoor air quality including: health effects, sources, impact of environmental parameters, typical levels in residences, and possible remedial measures. A brief mention of other organic pollutants concludes the discussion.

26068 (EPRI-EA/EM—3824, pp 9.1-9.14) **Combustion products from a variety of sources.** Moschandreas, D. (IIT Research Institute, Chicago, IL). Jan 1985. Research Reports Center, Box 50490, Palo Alto, CA 94303 $23.50. File Number TI85920206. (CONF-8403172—; CONF-8405169—).

From Indoor air quality seminar - implications for electric utility conservation programs; Atlanta, GA, USA (6 Mar 1984).

Scientists studying the indoor non-industrial environment have identified several major sources of indoor air pollution. Among them, combustion sources and their products have attracted considerable attention. Recent efforts to conserve energy by reducing the infiltration rate of a residence have enhanced the concern about indoor air quality, because concentrations of combustion products increase as the dilution of indoor generated pollutants by fresh outdoor air reduces. The emphasis of this work is on emissions from cooking and heating combustion sources, emissions from smoking will not be addressed extensively in this paper. Scientific inquiry into the indoor environment has focused on criteria pollutants. Going against convention, in this paper, non-criteria pollutants are reviewed first, a summary of information regarding criteria pollutants associated with emissions from indoor combustion sources follows.

26069 (EPRI-EA/EM—3824, pp 11.1-11.16) **Environmental Protection Agency's research program on indoor air quality.** Berg, D.R. (Environmental Protection Agency, Washington, DC). Jan 1985. Research Reports Center, Box 50490, Palo Alto, CA 94303 $23.50. File Number TI85920206. (CONF-8403172—; CONF-8405169—).

From Indoor air quality seminar - implications for electric utility conservation programs; Atlanta, GA, USA (6 Mar 1984).

The EPA air quality program is described under the following headings: the Federal government's role in indoor air quality, the interagency Committee on Indoor Air Quality, EPA statutory responsibilities objectives of EPA's research program, and EPA's research plans for Fiscal Year 1984.

26070 (EPRI-EA/EM—3824, pp 12.1-12.6) **DOE's Indoor Air Quality Program; past activity, the Residential Conservation Service Program; and research directions.** Millhone, J.P. (Dept. of Energy, Washington, DC). Jan 1985. Research Reports Center, Box 50490, Palo Alto, CA 94303 $23.50. File Number TI85920206. (CONF-8403172—; CONF-8405169—).

From Indoor air quality seminar - implications for electric utility conservation programs; Atlanta, GA, USA (6 Mar 1984).

DOE's indoor air quality activities involve a coordinated effort by the Office of Building Energy Research, the Office of Health and Environmental Research, the Office of Environmental Analysis, and the Office of Power Marketing Coordination. Activities related to indoor air quality in the buildings research program are reviewed and directions for the future are discussed.

26071 (EPRI-EA/EM—3824, pp 13.1-13.19) **Indoor air quality research in Canada.** Walkinshaw, D.S. (National Research Council of Canada, Ottawa). Jan 1985. Research Reports Center, Box 50490, Palo Alto, CA 94303 $23.50. File Number TI85920206. (CONF-8403172—; CONF-8405169—).

From Indoor air quality seminar - implications for electric utility conservation programs; Atlanta, GA, USA (6 Mar 1984).

The quality of indoor air as it affects health has become an important issue in Canadian public and scientific circles where concerns have been closely linked to energy conservation measures. This paper outlines Canadian indoor air quality research as it is presently being developed in the context of the government-funded building energy conservation research program where it ranks as the top priority activity. While the primary effort is now on UFFI research, this will shift to the broader indoor air quality problem over the next few years and with this in mind, some priority activities are suggested.

26072 (GKSS—84/E/54) **Distribution of hydrogen chloride in the plume of incineration ships: Results of sea-level in-situ measurements.** Weitkamp, C.; Lenhard, U. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1984. 31p. (CONF-8409222—1). NTIS (US Sales Only), PC A03/MF A01. File Number DE85751613.

From 5. international ocean disposal symposium; Corvallis, OR, USA (10 Sep 1984).

With 14 figs., 4 tabs.

Chlorinated hydrocarbon waste is routinely destroyed by incineration in a specially assigned area in the North Sea. Incineration products contain considerable quantities of hydrogen chloride which, although much less toxic than the original substances, does represent an air pollutant unless neutralized by sea water. The present paper summarizes the results of measurements of HCl near the sea surface in the plume of incineration ships. Concentration distributions are presented. The results allow the separate assessment of HCl dilution and removal.

26073 (KFK—3527) **Consequences of enhanced coal use in the Federal Republic of Germany.** Jaeger, J.; Halbritter, G.; Kupsch, C. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Abt. fuer Angewandte Systemanalyse). Jan 1985. 54p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE85751614.

Within the study the results of calculations of the time of doubling of the CO_2 concentration and of the temperature increase are investigated. It can be concluded that at present there are many uncertainties regarding both the development of the atmospheric CO_2 concentration as a result of the use of fossil fuels and the effects of increased CO_2-concentrations on the climate and that conclusions regarding energy policy, such as those drawn in the recent studies of the Environmental Protection Agency (EPA, 1983) and the Nuclear Research Center of Juelich (KFA, 1983), are difficult to support in view of the still considerable lack of knowledge. This evaluation is similar to that of a new study published by the U.S. National Academy of Science (CDAC, 1983). Since the potential long-term effects of climatic changes could, however, be considerable, the intensification of research into both the carbon cycle and climate modeling should be given priority.

26074 (KHM-TR—74) Plume model for nitrogen oxides. Persson, C.; Funkquist, L. (Statens Vattenfallsverk, Vaellingby (Sweden). Projekt KOL-HAELSA-MILJOE). May 1983. 51p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. File Number DE85750874.

A local and meso scale dispersion plume model including atmospheric chemistry for nitrogen oxides is developed. The purpose of the study is to obtain a practical air quality model which can be used in environmental planning work for e g coalfired power plants. Problems concerning both high concentrations of NO_2 in the air and deposition of different compounds to the ground are considered. In the numerical model the instantaneous plume dilution is described - assuming total mixing the plume - as a function of emission parameters and meteorological conditions. The interplay of emissions, instantaneous plume dilution, entrainment of polluted surrounding air, meteorological conditions and atmospheric chemistry processes determines the production or loss of the different compounds. On a local scale only 6 chemical reactions have to be included. On a somewhat larger scale the number of reactions needed increase substantially. For the numerical solutions we have used the method by Gear. Instantaneous plume concentrations and the NO_2 share of the total NO(sub) x in the plume at different conditions are obtained directly from the above mentioned calculations. In order to obtain 1-h mean values of different nitrogen oxides and long term depositions values conventional gaussian respectively k-formulation procedures are used. Meteorological input data are obtained from climatological observations and also generated by a dynamic boundary layer model. Results are shown from calculations for a coal fired power plant on a local scale (maximum distance 20 km). Concentration of different nitrogen oxides and estimated deposition values are shown as a function of emission factors, meteorological conditions and surrounding ozone concentration. From these results it is obvious that the meteorological conditions and the surrounding ozone concentration are of great importance to the relative amount of NO_2 in the plume.(author).

26075 (LA—10301-C) Atmospheric tracer workshop. Barr, S.; Clements, W.E.; Guthals, P.R. (comps.). (Los Alamos National Lab., NM (USA); USDOE Assistant Secretary for Environment, Washington, DC. Office of Health and Environmental Research). Dec 1984. Contract W-7405-ENG-36. 374p. (CONF-8405224—). NTIS, PC A16/MF A01; 1; GPO Dep. File Number DE85010573.

From Workshop on atmospheric tracers; Santa Fe, NM, USA (21 May 1984).

The Department of Energy (DOE) Office of Health Environmental Research sponsored an Atmospheric Tracers Workshop in Santa Fe, New Mexico, May 21-24, 1984. The objectives of the workshop were to summarize the status of atmospheric tracer technology; provide an information exchange forum for members of the atmospheric community; define areas for future application of tracers; and identify requirements for new tracer techniques. The workshop opened with a series of invited overview presentations on state-of-the-art tracer systems and/or atmospheric tracer applications. These presentations formed the basis for discussions in five working groups dealing with dry deposition and resuspension, global scale tracer applications, acid precipitation, natural sources of acid precipitation and organics, and regional air quality. The summaries of the discussions, the discussion group recommendations, and the overview papers are included in this proceedings document. Separate analytics have been done for each entry.

26076 (LBL—19166) New methods for characterizing soot emissions from fires. Rosen, H.; Hansen, A.D.A.; Dod, R.L.; Gundel, L.A.; Novakov, T. (Lawrence Berkeley Lab., CA (USA)). Feb 1985. Contract AC03-76SF00098. 17p. (CONF-8409178—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85009930.

From Conference on large scale fire phenomenology; Gaithersburg, MD, USA (10 Sep 1984).

Two new methods for characterizing soot emissions from fires will be described. One of these methods, the aethalometer, has the capability of measuring the absorbing component of soots (graphitic carbon) on a real-time basis. Such a capability is advantageous in aircraft studies of emission factors, aircraft studies of atmospheric aging and removal processes, and laboratory studies of time-dependent emissions from combustors. The other method, optical-thermal analysis, has the capability for unambiguous quantitation of both the graphitic and the various organic components of soot. Such separations are necessary for meaningful studies of the optical and chemical properties of soot and its emission factors. 10 refs. 7 figs.

26077 (NP—5750892) Air pollutants in the county of Joenkoeping, Sweden. Rapport 1983. Ericsson, U. (Laensstyrelsen i Joenkoepingslaen, Joenkoeping (Sweden). Naturvaardsenheten). Nov 1983. 112p. (In Swedish). NTIS (US Sales Only), PC A06/MF A01. File Number DE85750892.

The Joenkoeping Administration has undertaken a new survey of air pollution in the county, as a follow-up to the study undertaken in 1975. Since 1975, the emission of various pollutants into the atmosphere has changed. Some of the reasons for the changes are as follows: The sulfur content of heating oil has been reduced. During 1980 and 1981 the lead content of all petrol was reduced from 0.40 g/litre to 0.15 g/litre. Tighter controls were introduced for motor car exhaust emissions, commencing with vehicles built from 1976 onwards. Certain industries in the County have closed down, amongst them three pulp mills. A forecast has also been prepared of the likely conditions after 1990. During the next decade it is anticipated that pollution emissions will again change as a result of the following factors: A change-over from oil to various forms of solid fuel for heating purposes. A further reduction in the lead content of petrol from 1985. Provisions for cleaner exhaust emissions, to be introduced on vehicles built from 1988 onwards. A summary of pollution estimates prepared by the various local authorities provides the following emission situation for the County of Joenkoeping: (Emissions in 1000 tons/y) SO_2 10, 4, 3; NOx 9, 8.2, 6.2; Hydrocarbons 8.8, 6.9; CO 34, 36.5, 22.3; Particles 2, 1.5, 1.85; Pb 0.055, 0.025, 0.010 for the years 1975, 1983 and 1990-2000 resp. The main source of pollutants are: Energy production for SO_2 and particles, traffic for NOx, CO and Pb, and other sources for hydrocarbons.(L.E.).

26078 (PB—85-150852/XAB) Data screening and calculation procedures for the North American precipitation chemistry data to be used in the International Sulfur Deposition Model Evaluation. Voldner, E.C.; Sirois, A.; Clark, T.L. (Environmental Protection Agency, Research Triangle Park, NC (USA). Atmospheric Sciences Research Lab.; Atmospheric Environment Service, Downsview, Ontario (Canada)). Dec 1984. 17p. (EPA—600/D-84/294). NTIS, PC A02/MF A01.

Prepared in cooperation with Atmospheric Environment Service, Downsview (Ontario).

In the International Sulfur Deposition Model Evaluation seasonal and annual wet-sulfur-deposition amounts over eastern North America predicted by twelve models will be statistically compared with deposition amounts derived from networks in the same region. Since the methods for quality control and quality assurance of the precipitation chemistry data and procedure for computing wet-deposition amounts are not always in agreement between the networks, it was necessary to adopt unified procedures for screening/correcting the data and computing deposition amounts. A scheme was also developed for estimating the uncertainties in the wet-deposition amounts. The procedures for computing wet-deposition amounts and estimating the associated uncertainties are described and results from five networks in eastern North America are given.

26079 (PB—85-161578/XAB) Analytical methods for determination of POHC (principal organic hazardous constituents) in combustion products. Report for June 1983-February 1984. Adams, R.E.; James, R.H.; Burford, L.A.; Miller, H.C.; Johnson, L.D. (Southern Research Inst., Birmingham, AL (USA)). Feb 1985. 31p. NTIS, PC A03/MF A01.

The paper gives an overview of generalized analytical procedures for determining designated principal organic hazardous constituents (POHCs) in combustion products; it also gives some examples of the techniques used for compounds such as 2,3,7,8-tetrachlorodibenzodioxin, selenourea, and several organo-arsenicals. Emissions from hazardous-waste combustion must be monitored to determine the destruction removal efficiency (DRE) for each designated POHC. Analytical methods for more than 150 POHCs have been reviewed. A generalized HRGC/LRMS method to determine

volatile, thermally stable POHCs has been developed. A method based on HPLC with UV detection has also been developed to provide an alternative for determining nonvolatile or thermally labile compounds. The generalized methods are applicable to many compounds, but specific POHCs may require variations in GC/MS or HPLC procedures. Inclusion in the paper does not mean that the sampling or analysis method is an official EPA method. Official test methods for hazardous waste related programs are published in SW-846, Test Methods for Evaluating Solid Waste, as well as in the Federal Register.

26080 Calibration and evaluation of a real-time cascade impactor. Fairchild, C.I.; Wheat, L.D. (Los Alamos National Lab., NM). *American Industrial Hygiene Association Journal;* **45**: No. 4, 205-211(Apr 1984). Contract W-7405-ENG-36.

A 10-stage cascade impactor made by California Measurement Inc., can determine aerodynamic size distributions of dilute aerosols in a few minutes. Collection of impacted particles on greased, vibrating piezoelectric crystals produces changes in vibrational frequency proportional to the collected mass. Based on frequency changes and sampling time, a data reduction module calculates the mass collected on each stage. Calibration of the assembled impactor was performed with monodisperse polystyrene latex (PSL) and Eosin-Y (E-Y) aerosols for the lower stages (4-10), and PSL and pollen particles (ragweed and mulberry) for the upper stages (1-3). The stage experimental effective cutoff aerodynamic diameters (ECAD) were up to 22 percent different from theoretical ECADs with the exception of Stages 1 and 2 which were respectively 30 and 35 percent different from theoretical ECADs. The overall loss of particles $>$ 3- and $<$ 0.3-μm was severe. Also, considerable scatter of particles was observed on the collection crystals of Stages 1 and 2. Although a majority of particles were in the impaction area, a large fraction was scattered over the outer portions of these crystals.

26081 Climatic effects of atmospheric carbon dioxide. MacCracken, M.C.; Moses, H. (Lawrence Livermore National Lab., Livermore, CA). *Bulletin of the American Meteorological Society;* **64**: No. 5, 519-520(May 1983). Contract W-7405-ENG-48.

This response to a letter re-emphasizes the purpose of the Workshop on the First Detection of Carbon Dioxide Effects which, was to outline a research and analysis program that would provide the information needed to address more completely the issue of CO_2 warming of the environment and to determine ... whether or not [the climate models] may be grossly in error. The approach proposed by the Workshop participants indicated that definitive conclusions about climatic change should be based on correlated changes in an array of variables, rather than on selected changes in any single variable. A three-pronged effort was outlined to accomplish this objective.

5003 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 25326, 26010, 26100, 26103, 26124, 26183

26082 (EPRI-EA/EM—3824, pp 7.1-7.12) **Radon: one utility's experience.** Roberts, P.L. (Pennsylvania Power and Light, Allentown). Jan 1985. Research Reports Center, Box 50490, Palo Alto, CA 94303 $23.50. File Number TI85920206. (CONF-8403172—; CONF-8405169—).

From Indoor air quality seminar - implications for electric utility conservation programs; Atlanta, GA, USA (6 Mar 1984).

The complexity of the randon indoor air pollution problem is discussed in detail. Areas covered include radon sources in houses, measuring methods, dose response estimates, and mitigation measures.

26083 (IG—84-01) Tritium content of precipitation and surface water in Austria in 1983. Rank, D.; Rajner, V.; Lust, G. (Bundesversuchs- und Forschungsanstalt Arsenal, Vienna (Austria)). 1984. 33p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE85700593.

This report includes weighted monthly ^{3}H-means from 23 precipitation sampling stations, ^{3}H-concentrations of daily precipitation samples from the station Wien-Arsenal, and ^{3}H-concentrations of monthly samples from 17 surface water sampling stations. An abnormal ^{3}H-distribution in precipitation of March 1983 is discussed in detail.

26084 (PB—85-159036/XAB) Atmospheric transport of radioisotopes and the assessment of population doses on a European scale. Application of the MESOS code to the meteorological dispersion of radioactive discharges from national nuclear sites in the European Community with particular reference to the mesoscale. Final report. ApSimon, H.M.; Goddard, A.J.H. (Commission of the European Communities, Luxembourg; Imperial Coll. of Science and Technology, London (UK). Dept. of Mechanical Engineering). [1985]. 474p. (EUR—9128-EN). NTIS, PC E15/MF E01.

Prepared in cooperation with Imperial Coll. of Science and Technology, London (England), Dept. of Mechanical Engineering.

A model, called MESOS, to predict the medium- to long-range transport and dispersal of atmospheric releases of radionuclides, was developed. This model uses data derived from standard meteorological observations to follow the trajectories and dispersion of material released. It takes into account the evolving meteorological conditions in the boundary layer of the atmosphere, the synoptic scale wind, the intensity and duration of rain, etc. In order to apply the model to Western Europe, meteorological data bases providing the relevant information at three-hourly intervals were compiled. The model was used to compute the dispersal of hypothetical unit releases of selected radionuclides from five different source locations in different EC countries. The effects of continuous annual releases were simulated by suitably averaging the results for air exposure and for wet and dry deposition in order to permit the drawing of collective dose contour maps, using data grids of population distribution and food production. At selected receptor points around each source, the levels of contamination were calculated and analysed in the form of frequency or cumulative probability distributions. Illustrative results are presented to show the potential application of the MESOS model for the evaluation of possible long-range consequences of accidental releases.

26085 (RFP-ENV—84) Annual environmental monitoring report, January-December 1984. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 25 Mar 1985. Contract AC04-76DP03533. 63p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85011689.

This report documents the environmental surveillance program at the Rocky Flats Plant, as conducted by the Environmental Analysis and Control Section of the Environmental and Occupational Health Branch. Sample analyses are performed by the Health, Safety, and Environmental Laboratories of the Health, Safety and Environment Department and by the General Laboratory of the Quality Engineering and Control Department. The report includes an evaluation of Plant compliance with all appropriate guides, limits, and standards. Potential public radiation dose commitments were calculated from average radionuclide concentrations measured at the Plant property boundaries and in surrounding communities. Comparisons with appropriate guides, limits, and standards and with background levels from natural or other non-Plant sources, provide a basis for concluding that no adverse environmental effects were attributable to the operation of the Rocky Flats Plant during 1984. 24 refs., 12 figs., 23 tabs.

26086 Aerosols generated by accidents: pressurized liquid release experiments. Sutter, S.L.; Halverson, M.A. (Pacific Northwest Lab., Richland, WA). *American Industrial Hygiene Association Journal;* **45**: No. 4, 227-230(Apr 1984).

Safety assessments and environmental impact statements for facilities require an estimation of airborne releases from accidents. Aerosols generated by accidents are being investigated to develop the source terms for these releases. One example of a severe accidental release event is a pressurized liquid release. Pressurized liquid release experiments performed in static air measured the mass airborne as a function of source size and containment pressure. Pressurized releases with the containment breach above the liquid level were investigated. For this configuration, only containment pressure at the time of release was found to be a significant parameter. Releases in static air can be estimated using the relationships

developed in this work. Weight percent of the airborne source ranged from 4 x 10^4 to 0.15%. All of the pressurized releases produced a significant fraction of respirable particles.

5004 Thermal Effluents Monitoring And Transport

REFER ALSO TO CITATION(S) 26023

5006 Regulations

REFER ALSO TO CITATION(S) 26195

26087 (CONF-8306261—) Topical environmental questions 1983. (Institut fuer Gewerbliche Wasserwirtschaft und Luftreinhaltung e.V. (IWL), Koeln (Germany, F.R.)). 1983. 46p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE85770203.

From 3. IWL forum on current problems and tasks of environmental policy; Koeln, F.R. Germany (21 Jun 1983).

The papers read at the lecture meeting held in June 1983 are reprinted here. "Current problems and tasks of environmental policy" by a representative of the Federal Ministry of the Interior (Schuster, B.) deals with the environmental projects in the 10th legislative period of the German parliament and, generally, with the conflicting interests in which environmental protection today is embedded, both as far as party politics and established and non-established political groups are concerned. - "Prevention of environmental damage by the reduction of emissions and the principle of proportionality - a sector from the spherical expertise, by the council of experts on environmental questions, on damaged forest and air pollutions" by the chairman of that council (Salzwedel, J.) contains a thorough discussion of the principle of prevention, the development of that principle in clean air policy and the protection of waters, the difference from aimed protection against dangers, the principle of cooperation and the eventual introduction of economic instruments.

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

5101 Basic Studies

REFER ALSO TO CITATION(S) 26230

26088 (IC—84/35) Static and dynamic 3 dimensional studies of water in soil using computed tomographic scanning. Crestana, S.; Mascarenhas, S.; Pozzi-Mucelli, R.S. (International Centre for Theoretical Physics, Trieste (Italy)). Mar 1984. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700592.

Previous work of Petrovic, Siebert and Rieke demonstrated the possibility of using X-ray transmission computed tomography (CT) scanning for soil bulk density analysis in soil. We show in the present work that CT can also be used for the measurement of water content in soil. In our case we also show that CT can be applied to measure and follow dynamically the motion of water in soil in 3-dimensions. Further, more inhomogeneities of water content and motion in soil can be observed with this technique. Using a third generation CT scanner several different techniques can be applied such as differential, real time and spatial distribution scanning modes. A linear dependence was demonstrated for the Hounsfield Units (HU) used in CT and water content. The use of CT for water content and motion in soil in 3-dimensions opens new possibilities in this area of investigations.

26089 Role of livestock and black-tailed jackrabbits in changing abundance of Kochia americana. Clark, W.R.; Wagner, F.H. (Iowa State Univ., Ames). *Great Basin Naturalist;* **44**: No. 4, 635-646(31 Oct 1984).

Historical accounts and matched photographs indicate sharp decline of once-abundant Kochia americana in eastern Great Basin vegetation since the early 1900s, most of the decline by the late 1950s. Exclosure data show further decline from 1957 to 1973, then some increase between 1970 and 1973 and 1976 and 1981. Utah sheep numbers, at maximum from 1925 to 1940 and declining steadily to the 1970s, may have induced the long-term changes. Black-tailed jackrabbits (Lepus californicus), could not have induced vegetation decline, but could have added to livestock pressure and abetted the trend. In 1972, rabbits near a cyclic high were indirectly estimated to completely utilize K. americana in Curlew Valley, northwestern Utah. In 1976-1977 at rabbit low, direct measurements show 4%-18% of plants browsed by late summer, about 30%-50% of herbage removed from browsed plants. The latter rose to 45%-82% by end of winter. Late-summer percent browsed may have risen slightly (11%-21%) in 1980-1981 at next rabbit high. Increase in K. americana density from 1973 to 1976, then a slight decrease from 1976 to 1980, suggests fluctuating K. americana abundance induced by rabbit browsing, superimposed on long-term K. americana decline and recovery. 41 references, 3 figures, 5 tables.

26090 Aggregation error in nonlinear ecological models. Cale, W.G.; O'Neill, R.V.; Gardner, R.H. (Oak Ridge National Lab., TN). *Journal of Thermal Biology;* **100**: 539-550(1983). Contract W-7405-ENG-26.

Conditions are presented for accurately representing the dynamics of several components of a nonlinear ecological system by a single state variable. For mass-balance ecosystem models, only two conditions exist that permit such aggregation without introducing error into the model. Under the first condition, components can be lumped if their environmental losses (e.g. respiration or migration) are characterized by identical linear functions. Under the second condition, the components must maintain constant proportionality throughout their transient behavior. If these conditions are violated, it is not possible to aggregate without error. However, it is shown that aggregation error can still be minimized. The theorems developed here extend related results derived for the general theory of systems and have the advantage of generality, being applicable to nonlinear models of considerable complexity. 12 references, 2 figures.

5102 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 25772, 25777, 25778, 26085, 26103, 26113, 26191

26091 (CONF-8303106—, pp 401-412) **Microbiological aspects of mobilization and buffering of heavy metals in soil.** Domsch, K.H. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE85770201.

From 16. Essen meeting on sewage sludge - raw material or pollutant; Essen, F.R. Germany (9 Mar 1983).

Soil microorganisms can take up heavy metal ions from the surrounding chemical environment, store them and return them to the soil in a mobile form. Microbial degradation of organic substances leads to the liberation of heavy metals, which in turn can interfere with mineralisation processes. The influences of soil microorganisms on inorganic phase equilibria are presented and discussed.

26092 (CONF-8303106—, pp 413-438) **Transport behaviour of pollutants in the soil.** Matthess, G. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE85770201.

From 16. Essen meeting on sewage sludge - raw material or pollutant; Essen, F.R. Germany (9 Mar 1983).

With the use of waste water and sewage sludge as fertilizers, inorganic and organic toxic substances reach the soil. Their transport behaviour in the various oil horizons is dependent on solubility, hydrogen ion-content, redox potential and adsorption-desorption behaviour. The presence of strongly sorptive organic matter favours enrichment of the toxic substances in the upper-most soil layers. However washing out of the substances leading to contamination of the ground water must be taken into account. The basic transport mechanisms of these substances are presented.

26093 (CONF-8303106—, pp 439-449) **Effects of heavy metal pollution from sewage sludge on land used for agricultural purposes.** Schweiger, P. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE85770201.

From 16. Essen meeting on sewage sludge - raw material or pollutant; Essen, F.R. Germany (9 Mar 1983).

The basis for an ecologically digestible agricultural use of sewage sludge (sewage sludge ordinance) is the limited input of lead (2kg), cadmium (35g), chromium (2kg), copper (2kg), nickel (333g), mercury (40g) and zinc (5kg/ha and year) on agricultural land. These "tolerable heavy metal inputs" are dimensioned such that with normal usage (5t sewage sludge dry matter every 3 years) no damage to the soil occurs according to the present state of scientific knowledge. According to our own investigations and other published data it is evident that through use of sewage sludge and similar waste products the total amount of heavy metals in the soil increases by the amount added. The average actual input is thereby clearly under the tolerance limit. The solubility of the heavy metals added is, however, even after years distinctly higher than the heavy metals already present in the soil. With chemical methods of extraction the amount actually relavant for plants cannot be ascertained in either case. Further effects of heavy metals from sewage sludge, e.g. on soil biology are not known. However, through improper use of sewage sludge damage to the soil can take place, such as clogging etc.

26094 (CONF-8303106—, pp 451-469) **Absorption of heavy metals by plants cultivated on land fertilized with sewage sludge.** Diez, T. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE85770201.

From 16. Essen meeting on sewage sludge - raw material or pollutant; Essen, F.R. Germany (9 Mar 1983).

The establishment of limiting values for heavy metal concentrations in soils as stipulated in the new sewage sludge ordinance was based on the experience that excessive heavy metal concentrations in soils led to growth deformities in plants or consumption of these plants would be a health hazard. The experimental results presented here show that the heavy metal up-take of plants is dependent on a number of factors, e. g. on heavy metal concentration and distribution in the soil; on soil properties, such as type of soil, pH, humus content; on plant species, plant organ, type and on climatic influences during the growth period. The new sewage sludge ordinance takes these factors into consideration. The limiting values are thus fixed at levels low enough so that even under unfavourable circumstances no harmful heavy metal effects are to be expected.

26095 (CONF-8303106—, pp 627-662) **Importance of the nitrogen cycle in soils for the agricultural industry and for the supply and distribution of water.** Sauerbeck, D. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE85770201.

From 16. Essen meeting on sewage sludge - raw material or pollutant; Essen, F.R. Germany (9 Mar 1983).

Nitrogen exists in soils in varying amounts and forms which depend on local soil forming and management conditions. Among these different nitrogen compounds the readily soluble nitrate of intensely farmed agricultural soils causes particular environmental concern. This is not only true for restricted water protection zones and for areas with excessive or one-sided fertilization. Even well balanced agricultural fertilizer utilizations become more and more questioned from the water management point of view. In order to understand this principal conflict, a sufficient knowledge of the nitrogen metabolism of soils, both qualitatively and quantitatively, is required. Taking the natural nitrogen cycle as an example, it can be shown that nitrate losses may principally not be avoided by all systems of soil utilization. Their extent, however, depends on the farming intensity and increases inevitably when the nutrient content and the nitrogen turnover of soils are increased. This means that any kind of soil fertility improvement necessarily entails ambivalent environmental consequences. The amounts and forms of nitrogen circulating in agro-ecosystems are, therefore, discussed and the possibilities existing to minimize nitrate losses are outlined. The fact, however, that such losses can only be reduced but not completely controlled, leads to the conclusion that most effective food production on the one hand, and highest possible water purity on the other, can not be completely reconciled. An acceptable compromise in this dilemma can only be aimed at by agriculture and water management authorities jointly recognizing each other's requirements and limitations.

26096 (DOE/OR/21400—T113) **Comparative evaluation of the effects of acid precipitation, natural acid production, and harvesting on cation removal from forests.** Johnson, D.W. (Oak Ridge National Lab., TN (USA)). [1985]. Contract AC05-84OR21400. 90p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85010821.

A comparison was made of the effects of acid deposition, natural leaching, and harvesting on base cation export from coniferous forests in Maine, coniferous and deciduous forests in Tennessee, a coniferous forest in South Carolina, a deciduous forest in North Carolina, and coniferous and deciduous forests in Washington. Sulfate dominated leaching in the Tennessee sites, whereas HCO_3^- dominated leaching in the Maine, North Carolina, South Carolina, and Washington sites (the latter because of very high HCO_3^- and NO_3^- leaching rates). Nitrate leaching was negligible in all but a red alder site in Washington where nitrogen fixation resulted in net NO_3^- leaching. Total base cation export by leaching exceeded $Ca^{2+} + Mg^{2+} + K^+$ export that results from whole-tree harvesting in most sites. The export of Na^+ via harvesting was assumed to be negligible compared with that of Ca^{2+}, Mg^{2+}, and K^+. However, leaching, even as augmented by acid deposition, does not appear to pose an imminent threat to soil base cation supplies on sites for which soil data are available. This is basically because soil base cation reserves are very large relative to leaching rates. Some sites showed a net Ca^{2+} or K^+ accumulation from atmospheric deposition until they were subjected to whole-tree harvesting. Thus, leaching need not cause a net export of all nutrient cations, even if total base cation export is accelerated by acid deposition. 32 refs., 2 figs., 5 tabs.

26097 (Juel-Spez—274) **Methods of ecotoxicological evaluation of chemicals. Vol. 3.** Fuehr, F.; Stuettgen, E.; Scheele, B. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Projekttraeger fuer Umweltchemikalien). Sep 1984. 323p. (In German). NTIS (US Sales Only), PC A14/MF A01. File Number DE85751612.

In this report the results of 13 research projects are presented. They are sponsored by the Department of Research and Technology within the project 'Methods of ecotoxicological evaluation of chemicals', in order to check, standardize, improve and develop procedures to test environmental chemicals under ecotoxicological aspects. All of the 13 individual projects described here, deal with different sectors of terrestrial ecosystems. In a vineyard the present state situation is analysed, for a grassland and agricultural system 'Modell-Ecosystems' were developed. Another group of methods are concerned with soil/contamination by heavy metals and organic chemicals. Finally procedures are presented to check the toxicity of compounds secreted on nectar and applicability of Acridid Species in toxicity tests.

26098 (NP—5770282) **Concentrations of the heavy metals Cd, Tl, Pb, Bi and further trace elements in natural soils and their bedrocks in Southern Germany.** Walk, H. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Bio- und Geowissenschaften). 5 May 1982. 177p. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE85770282.

The concentrations of Cd, Tl, Pb and Bi in rocks and soils developed thereon were measured by means of flameless atomic absorption spectroscopy. The results, along with the findings of activation analyses of other elements and further pedological parameters, are used as a basis for a discussion of the pedogeochemistry of these elements. In order to assess the anthropogenic contribution, samples were taken in a former lead and zinc mining region.

26099 **Hazardous materials management and control program at Oak Ridge National Laboratory - environmental protection.** Eisenhower, B.M.; Oakes, T.W.; Braunstein, H.M. (Oak Ridge National Lab., TN). *American Industrial Hygiene Association Journal;* **45**: No. 4, 212-221(Apr 1984). Contract W-7405-ENG-26.

At a large research laboratory facility the management and control of hazardous materials, and their subsequent waste can be an unmanageable task. Environmental regulations, mandated by the Resource Conservation and Recovery Act of 1976, established a Federal program to provide comprehensive regulation of hazardous solid waste materials from their generation time to their disposal. In an effort to comply with these regulations, a Hazardous Materials Management and Control program was created at Oak Ridge National Laboratory. The program provides personnel with specific guidelines for the procurement, use, storage, transportation and disposal of hazardous materials/wastes, and ensures that they are managed in a manner which adequately protects all personnel, the general public, and the environment.

5103 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 25322, 25324, 26085

26100 (ANL—85-17) Environmental monitoring at Argonne National Laboratory. Annual report for 1984. Golchert, N.W.; Duffy, T.L.; Sedlet, J. (Argonne National Lab., IL (USA)). Mar 1985. Contract W-31-109-ENG-38. 109p. NTIS, PC A06/MF A01; GPO Dep. File Number DE85010613.

The results of the environmental monitoring program at Argonne National Laboratory for 1984 are presented and discussed. To evaluate the effect of Argonne operations on the environment, measurements were made for a variety of radionuclides in air, surface water, ground water, soil, grass, bottom sediment, and milk; for a variety of chemical constituents in surface water, ground water, and Argonne effluent water; and of the environmental penetrating radiation dose. Sample collections and measurements were made on the site, at the site boundary, and off the Argonne site for comparison purposes. The potential radiation dose to off-site population groups is also estimated. The results of the program are interpreted in terms of the sources and origin of the radioactive and chemical substances (natural, fallout, Argonne, and other) and are compared with applicable environmental quality standards. 20 refs., 8 figs., 46 tabs.

26101 (DOE/ER/10275—1A) Transactions of the 1982 Western Regional American Nuclear Society student conference. (Oregon State Univ., Corvallis (USA)). 1982. Contract FG02-82ER10275. 37p. (CONF-820359—Absts.). NTIS, PC A03/MF A01. File Number DE83004080.

From Western regional American Nuclear Society student conference; Corvallis, OR, USA (28 Mar 1982).

All 12 papers were entered into the data base. (MOW)

26102 (DOE/ER/10275—1A, pp 2, Paper 1) Natural radioactivity in building materials. McGovern, G.E. (Arizona State Univ., Tempe). 1982. NTIS, PC A03/MF A01. File Number DE83004080. (CONF-820359—Absts.).

From Western regional American Nuclear Society student conference; Corvallis, OR, USA (28 Mar 1982).

This research examines the radionuclide concentrations of popular building materials by gamma spectrometry. Three major naturally-occurring long-lived primordial radionuclides are usually present in construction materials. They are U-235, U-238 and Th-232. U-235 is of minor significane due to its small proportion (by weight) in natural uranium. In the U-238 decay series the radionuclides which can be measured by gamma spectrometry include: Ra-226, Pb-214 and Bi-214. In the Th-232 decay series the radionuclides of primary interest are: Ac-228, Pb-212, Bi-212 and Tl-208. Besides the two significant natural decay series, K-40 was found in many of the materials and will be included in the results. Samples of building materials were collected from throughout the United States and Canada. One liter volumes of each were crushed and added to a specially prepared marinelli beaker and qualitatively assayed by a GeLi detector. The samples were then transferred to a NaI (Tl) detector, to obtain a quantitative assay of the material. Findings will be presented along with their implications. 2 references.

26103 (MHSMP—85-17) Environmental monitoring report for Pantex Plant covering 1984. Laseter, W.A. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, TX (USA)). 22 Apr 1985. Contract AC04-76DP00487. 57p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85010824.

This report summarizes the environmental monitoring program at Pantex Plant for 1984. It has been prepared in accordance with the United States Department of Energy Order 5484.1. This report presents monitoring data for both radioactive and non-radioactive species in the local environment. Plant activities involve the handling of significant quantities of uranium, plutonium, and tritium. However, only a small release of tritium occurred which could have affected the local environment. Monitoring data indicate that concentrations of this nuclide in the environment are below established criteria for air and water and therefore should not present a health hazard either to employees or to the public. 22 refs., 7 figs., 23 tabs.

26104 Perspective on radioecological research. Auerbach, S.I. (Oak Ridge National Lab., TN (USA)). *Journal of the Society for Radiological Protection;* **4**: No. 3, 100-105(Aut 1984).

Much current radioecological research has been directed toward enhancing our knowledge of radionuclide transport in major environments in order to derive transfer coefficients for radiological dose assessment codes. Most current radioecological research is centred on operating nuclear installations which provide major opportunities for developing new insights on nuclide behaviour and for training students. This type of effort should continue to be encouraged in the future because of the distinct advantages offered by such locations. Future radioecological research will be needed for predicting exposures resulting from the transport of radionuclides in agricultural food chains. Model validation using field studies and experiments is another pressing area of radioecology. There is a continuing need for data on the long-term impact of chronic low level ionizing radiation on species and populations in natural systems in relation to such problems as radioactive waste disposal. Lastly, there is an opportunity for the continuing use of radioisotopes as tools for research in basic ecology and for attacking non-radioactive pollution problems.

5105 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 25172, 25317

26105 Checklist of the vascular plants on the Department of Energy Oak Ridge Reservation. Mann, L.K.; Patrick, T.S.; DeSelm, H.R. (Oak Ridge National Lab., TN). *Journal of the Tennessee Academy of Science;* **60**: No. 1, 8-13(Jan 1985). Contract AC05-84OR21400.

Plants have been collected on the Department of Energy Oak Ridge National Reservation for over 30 years in conjunction with environmental research at Oak Ridge National Laboratory. The site includes a wide diversity of habitats, ranging from open water to mesic forests, including several cedar barrens. The vascular plant checklist of the site contains 114 families, 458 genera, and 842 species, subspecies, and varieties, and includes a number of rare species. A summary of numbers of species in different habitats indicates that the greatest diversity occurs in open woods or thickets or mesic sites.

26106 Survey and assessment of the rare vascular plants of the Idaho National Engineering Laboratory Site. Cholewa, A.F.; Henderson, D.M. (Univ. of Idaho, Moscow). *Great Basin Naturalist;* **44**: No. 1, 140-144(31 Jan 1984). Contract AT07-81ID12308.

A two-year study of the rare vascular plants of the Idaho National Engineering Laboratory generated new data on the abundance, distribution, and habitat features of eight taxa presently under review at either the federal or state level, or recently proposed for such review. Astragalus ceramicus Sheld. var. apus Barneby is common on the INEL and adjacent areas and will be recommended for removal from further consideration at the federal

level and placed on Idaho's Federal Watch List. Coryphanta missouriensis (Sweet) Britt & Rose is common throughout east central Idaho, but will be recommended for retainment on the State Watch List. Gymnosteris nudicaulis (H. & A.) Greene and Oxytheca dendroidea Nutt. are also recommended for retention on the State Watch List. Four taxa not previously known to occur in Idaho or not known from the southeastern part of the state (Astragalus gilviflorus Sheld., Astragalus kentrophyta Gray var. jessiae (Peck) Barneby, Gilia polycladon Torr., and Lesquerella kingii S. Watts. var. cobrensis Roll. & Shaw) were encountered and evaluated with reference to current or potential threats, and are recommended for placement on Idaho's State Watch List. 14 references, 1 figure.

5106 Regulations

REFER ALSO TO CITATION(S) 25698

52 ENVIRONMENTAL SCIENCES, AQUATIC

5201 Basic Studies

REFER ALSO TO CITATION(S) 26090

26107 **Methods for the large-scale cultivation of an Oxytricha (ciliophora:hypotrichida).** Laughlin, T.J.; Henry, J.M.; Phares, E.F.; Long, M.V.; Olins, D.E. (Oak Ridge National Lab., TN). *Journal of Protozoology, The;* 30: No. 1, 63-64(1983). Contract W-7405-ENG-26.

Oxytricha strains used in biochemical studies have traditionally been grown in unaerated, unagitated culture tubes or Fernbach flasks. These cultures are limited in volume to about one liter and have a very nonuniform distribution of cells, with the majority of the cells at the very top or bottom of the medium. We have found conditions and designed experiments in which Oxytricha can be grown in 50-liter fermentation vats. The cultures grow to a uniform density of about 6000 cells/ml. 2 references, 2 figures.

5202 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 25161, 25171, 25174, 25240, 25598, 25599, 25772, 25969, 26023, 26085, 26092, 26095, 26103

26108 (CONF-8303106—, pp 371-386) **Origin of heavy metals in domestic waste water.** Koppe, P.; Klopp, R. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE85770201.

From 16. Essen meeting on sewage sludge - raw material or pollutant; Essen, F.R. Germany (9 Mar 1983).

Heavy metals, whose contents are limited in sewage sludge for agricultural purposes, are to be found in measurable quantities not only in communal waste water, with its changing portions of polluted storm water, and industrial waste water, but also in domestic waste water. Examples are used to show the amount of heavy metal pollution resulting from drinking water, eatables and cleaning water. Even though heavy metals from domestic waste water contribute to the heavy metal load to the sewage sludge, they cause an infringement of the limiting values only in very rare cases.

26109 (CONF-8303106—, pp 387-399) **Cadmium balance as a base for specific sanitation measures.** Koppe, P.; Imhoff, K.R. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE85770201.

From 16. Essen meeting on sewage sludge - raw material or pollutant; Essen, F.R. Germany (9 Mar 1983).

In order to reduce the cadmium concentrations of river water and sewage sludges, a cadmium balance and subsequent identification and restoration strategies have been developed in the Ruhr basin. The intensified control program includes identification of unlawful industrial discharges under cover of darkness as well as consulting of the particular industrial plants. First encouraging results are dealt with.

26110 (CONF-8303106—, pp 577-591) **Possibilities of nitrate degradation in drainage- and ground water.** Obermann, P. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE85770201.

From 16. Essen meeting on sewage sludge - raw material or pollutant; Essen, F.R. Germany (9 Mar 1983).

The intended reduction of NO_3-limit in drinking water for the Federal Republic of Germany in 1985 from 90 to 50 mg NO_3/l will cause considerable problems in water supply. The increasing use of fertilizer has a growing influence on the nitrate concentration in groundwater. The concentration of NO_3 percolating into the aquifer, its distribution and the reduction within some aquifers have been studied by using a newly developed sampling technique. The microbial and dissimilative nitrate reduction was quantitatively determined by consideration of the vertical component of groundwater flow. Linked with the NO_3-reduction are certain alterations of hydrochemical data in the groundwater (consumption of O_2 and NO_3 combined with production of CO_2 and N_2 by microbial respiration, increasing pH-value and HCO_3-concentration, decreasing Eh-value).

26111 (CONF-8303106—, pp 593-608) **Investigation program on nitrate content in ground water under land used for agriculture.** Kalthoff, H. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE85770201.

From 16. Essen meeting on sewage sludge - raw material or pollutant; Essen, F.R. Germany (9 Mar 1983).

The investigation was motivated by the increasing nitrate concentrations in ground water and the EEC regulation demanding a limiting value of max. 50 mg/l NO_3 in drinking water from 1985 onwards. Since fertilization followed by increased intensification in all fields of agriculture is seen as the main cause of increasing nitrate concentrations, the correlation between agricultural fertilization and the nitrate concentration in ground water is being investigated at four different places in Northrhein-Westfalia. The program consists of four different fertilization procedures on a total of 36 experimental plots, taking into consideration the natural crop rotation practised. Presently, the measurements of nitrate concentrations and other necessary parameters take place once every fortnight on seepage and ground water surface.

26112 (CONF-8303106—, pp 609-619) **Possibilities for solving the nitrate problem in Northrhine-Westphalia.** Grossteinbeck, J. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE85770201.

From 16. Essen meeting on sewage sludge - raw material or pollutant; Essen, F.R. Germany (9 Mar 1983).

The conclusions obtained from the investigations on the influence of fertilization of agricultural land on the nitrate content, specially for the water management policy of Northrhein-Westfalia are presented.

26113 (CONF-8303106—, pp 663-678) **Influence of sewage sludge on water pollution by runoff and leaching of nutrients.** Furrer, O.J. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE85770201.

From 16. Essen meeting on sewage sludge - raw material or pollutant; Essen, F.R. Germany (9 Mar 1983).

Sewage sludge contains a large amount of substances which could pollute the water bodies. The extent of risk of water pollution through runoff and leaching are illustrated by the results of lysimeter experiments. The necessary measures to prevent water pollution in connection with sewage sludge application are discussed and the regulations connected to this which are prescribed in the Swiss sewage sludge ordinance are presented.

26114 (CONF-8303106—, pp 679-704) **Limits and possibilities of denitrification of soil.** Kuntze, H. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE85770201.

From 16. Essen meeting on sewage sludge - raw material or pollutant; Essen, F.R. Germany (9 Mar 1983).

The increasing nitrate load on ground water and the more stringent demands stipulated by the new EEC guidelines on the quality of drinking water require intensive efforts in order to minimise the nitrate content of the waters. It is open to question wheth-

er the microbial denitrification in the soil should not be considered more attentively. In addition to a corresponding NO_3 supply in the soil solution, light, degradable, organic substances as C-suppliers for the heterogenic denitrificants that can be included at least facultative aerobically in the process above 10°C are essential for optimum denitrification up to inert N_2 gas. From a water management viewpoint, the unused NO_3-N-contents of the soil are particularly harmful since they can be washed out during winter. Possible water management during this period through submersion irrigation is prevented by the low soil temperatures. On the other hand, during the vegetation period high ground water levels are not compatible with the demands of rational agriculture. Since in practice denitrification exhibits clear limits, it is possible to stop the denitrification at the stage of ammonium liberation with the help of nitrificides that effect specifically the nitrificants. The effect of the nitrificide DIDIN is described in more detail. At low temperatures it inhibits the nitrification of the liquid manure nitrogen up to 4 months, so that the fall-winter liquid manure output is less of a problem. In comparison to mineral fertilization without the addition of DIDIN, during the first year an average of 20% less nitrate-N was carried away via drains, increasing to 30% in the second year and an astonishing 50% in the third year.

26115 (CONF-8303106—, pp 705-716) **Hygienist's view on nitrates in drinking water.** Althaus, H. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE85770201.

From 16. Essen meeting on sewage sludge - raw material or pollutant; Essen, F.R. Germany (9 Mar 1983).

After discussing the presence of nitrates in foodstuffs and drinking water, their concentration in drinking water and the secondary effect after the formation of nitrites through bacterial reduction in the body are presented. The occurence of methemoglobinemia in babies and nitrosamines with their potentially carcinogenic influence are elucidated.

26116 (CONF-8303106—, pp 733-753) **Problems and possibilities of nitrate elimination from drinking water preparation.** Haberer, K. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE85770201.

From 16. Essen meeting on sewage sludge - raw material or pollutant; Essen, F.R. Germany (9 Mar 1983).

Nitrate ions cannot be precipitated and chemically reduced under situations simulating practical conditions. They can be precipitated through the reversible osmosis and ion-exchange processes, however at the same time other ions or molecules are also removed from the water. Thus denitrification with this method is always coupled to partial desalination. As a membrane process, reverse osmosis requires prepurified raw water and a relatively high amount of energy, whereas ion-exchange requires a large amount of chemicals. The effort can possibly be reduced through special operating and regenerating procedures. However, both processes pose the problem of elimination of strongly salinated waste waters. The most promising method of nitrate elimination in the future is the reduction of the nitrate to elemental nitrogen with the help of heterotrophic or autotrophic bacteria. They develop in following media through steady addition of usable organic compounds such as methanol or sugar or through molecular hydrogen. The processes cannot yet be employed on a technical level. The operating reliability and the efficiency have to be improved.

26117 (CONF-8303106—, pp 755-781) **Application of ion exchangers for nitrate and sulfate elimination in the preparation of drinking water.** Hoell, W.; Eberle, S.H. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE85770201.

From 16. Essen meeting on sewage sludge - raw material or pollutant; Essen, F.R. Germany (9 Mar 1983).

Ion exchange processes can be used for nitrate and sulfate elimination from natural water since both ions are preferred by anion exchange resins. The order of affinity towards the most important anions is $SO_4 > NO_3 > Cl > HCO_3$. In conventional processes sulfate and nitrate are replaced by chloride ions and sodium chloride is utilized for regeneration of the resins. The disadvantages of this method are the increase of chloride concentration in the product water and the discharge of large amounts of salt into bodies of water in the regeneration cycle. These problems are diminished in a number of alternative processes, which are discussed individually.

26118 (PB—85-154201/XAB) **Protecting the nation's groundwater from contamination. Volume 1.** (Office of Technology Assessment (U.S. Congress), Washington, DC). Oct 1984. 245p. (OTA-O—233). NTIS, PC A11/MF A01.

See also PB85-154219. Library of Congress Catalog Card No. 84-601126.

The objective of the OTA study is to assess the current status of the Nation's knowledge and experience in dealing with groundwater contamination problems. The study focuses on existing contamination problems, while recognizing that the prevention of future contamination would also need to be explicitly considered in order to develop a policy framework for comprehensive resource protection; for example, as experience with hazardous wastes has shown, the cost to clean up contamination can be enormously greater than the cost to prevent contamination. Thus, the structure of the study evolved around the concept of protecting groundwater quality, comprised of activities to detect, correct and prevent groundwater contamination.

26119 (PB—85-154219/XAB) **Protecting the nation's groundwater from contamination. Volume 2.** (Office of Technology Assessment (U.S. Congress), Washington, DC). Oct 1984. 271p. (OTA-O—276). NTIS, PC A12/MF A01.

See also PB85-154201.

The objective of the OTA study is to assess the current status of the Nation's knowledge and experience in dealing with groundwater contamination problems. The study focuses on existing contamination problems, while recognizing that the prevention of future contamination would also need to be explicitly considered in order to develop a policy framework for comprehensive resource protection; for example, as experience with hazardous wastes has shown the cost to clean up contamination can be enormously greater than the cost to prevent contamination.

26120 (USGS/WRI—83-4239) **Overview of ground-water quality data in Wisconsin.** Kammerer, P.A. Jr. (Geological Survey, Madison, WI (USA). Water Resources Div.). Feb 1984. 73p. US Geological Survey Open File Services, Box 25425, Denver Federal Center, Denver, CO 80225. File Number TI85901356.

This report contains a summary of ground-water-quality data for Wisconsin and an evaluation of the adequacy of these data for assessing the impact of land disposal of wastes on ground-water quality. Chemical analyses used in data summaries were limited to those stored in the USGS computer system (WATSTORE). Information on documented instances of ground-water contamination and sources of potential contamination from land disposal of wastes was provided by the Wisconsin Department of Natural Resources. Available data provide an overview of ground water quality but may be insufficient for assessment of ground-water contamination from land disposal of wastes. Many sources of potential groundwater contamination (landfills, surface waste-storage impoundments, and buried tanks) are known. Some of these are probably causing local ground-water contamination that is not apparent from available regional data. Information needs for assessment of groundwater contamination from land disposal of wastes include improved understanding of ground-water hydrology and the chemical behavior of specific contaminants in the environment. 19 refs., 21 figs.

26121 (USGS/WRI/OFR—81-919) **Ground-water quality in the vicinity of landfill sites, southern Franklin County, Ohio.** de Roche, J.T.; Razem, A.C. (Geological Survey, Columbus, OH (USA). Water Resources Div.). 1981. 24p. US Geological Survey Open File Service, P.O. Box 25425, Denver, CO 80225. File Number TI85901389.

The hydrogeology and ground-water quality in the vicinity of five landfills in southern Franklin County, Ohio, were investigated by use of data obtained from 46 existing wells, 1 seep, 1 surface-water site, and 1 leachate-collection site. Interpretation was based on data from the wells, a potentiometric-surface map, and chemical analyses. Four of the five landfills are in abandoned sand and gravel pits. Pumping of water from a quarry near the landfills has

modified the local ground-water flow pattern, increased the hydraulic gradient, and lowered the water table. Ground water unaffected by the landfills is a hard, calcium bicarbonate type with concentrations of dissolved iron and dissolved sulfate as great as 3.0 milligrams per liter and 200 milligrams per liter, respectively. Water sampled from wells downgradient from two landfills shows an increase in sodium, chloride, and other constituents. The change in water quality cannot be traced directly to the landfills, however, because of well location and the presence of other potential sources of contamination. Chemical analysis of leachate from a collection unit at one landfill shows significant amounts of zinc, chromium, copper, and nickel, in addition to high total organic carbon, biochemical oxygen demand, and organic nitrogen. Concentrations of chloride, iron, lead, manganese and phenolic compounds exceed Ohio Environmental Protection Agency Water Quality Standards for drinking water. Water from unaffected wells within the study area have relatively small amounts of these constituents. 7 refs., 3 figs., 2 tabs.

26122 **Effects of stream channelization on exports on nitrogen and phosphorus from North Carolina coastal plain watersheds.** Yarbro, L.A.; Kuenzler, E.J.; Mulholland, P.J.; Sniffen, R.P. (Harbor Branch Foundation, Inc., Fort Pierce, FL). *Environmental Management;* 8: No. 2, 151-160(Mar 1984).

Nitrogen and phosphorus exports from channelized-stream watersheds were elevated over those from nearby natural swamp-stream watersheds. Nitrate exports were significantly greater from channelized-stream watersheds, and higher exports were attributed to faster groundwater drawdown, continual streamflow, and transformation of former floodplain to croplands following channelization. Exports of total organic nitrogen and total nitrogen were also significantly greater from channelized-stream watersheds. Differences in the exports of ammonium, filterable reactive phosphorus, and filterable unreactive phosphorus between the two watershed types were not detectable. Changes in local groundwater hydrology and stream morphology associated with channelization appeared to have greater effect on nutrient exports than simply the loss of bordering forested floodplain. 25 references, 4 figures, 2 tables.

5203 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 25313, 25314, 25323, 26083, 26085, 26100, 26103, 26104

26123 **(CONF-850473—2) Role of natural dissolved organic compounds in determining the concentrations of americium in natural waters.** Nelson, D.M.; Orlandini, K.A. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010266.

From Seminar on the speciation of fission products in the environment; Oxford, UK (16 Apr 1985).

Concentrations of ^{241}Am, both in solution and bound to suspended particulate matter, have been measured in several North American lakes. Dissolved concentrations vary from 0.4 μBq/L to 85 μBq/L. The ^{241}Am in these lakes originated solely from global fallout and hence entered all lakes in the same physiocochemical form. The observed differences in solubility behavior must, therefore, be attributable to chemical and/or hydrological differences among the lakes. Concentrations of dissolved ^{241}Am are highly correlated with the corresponding concentrations of /sup 239, 240/ Pu(III,IV), suggesting that a common factor is responsible for maintaining both in solution. The K/sub D/ values for ^{241}Am and /sup 239, 240/Pu(III,IV) are highly correlated with the concentrations of dissolved organic carbon (DOC) in the waters, suggesting that the common factor is the formation of soluble complexes with natural DOC for both elements. This hypothesis was tested in a series of laboratory experiments in which the DOC from several of the lakes was isolated by ultrafiltration. Plots of K/sub D/, as a function of DOC concentration, show K/sub D/ to be very high ($\sim 10^6$) at low DOC concentrations. Above critical concentrations (a few mg/L DOC) the K/sub D/ values begin a progressive decrease with increasing DOC. We conclude that in most surface waters, the dissolved ^{241}Am concentration is regulated by an adsorption/desorption equilibrium with the sediments (and suspended solids) and the value of K/sub D/ that characterizes this equilibrium is largely determined by the concentration of natural DOC in the water. 11 refs., 3 figs., 2 tabs.

26124 **(PB—85-164838/XAB) Environmental Radiation Data, report 38, April-June 1984. Final report.** Petko, C. (Environmental Protection Agency, Montgomery, AL (USA). Eastern Environmental Radiation Facility). Sep 1984. 43p. (EPA/520/5—84/029). NTIS, PC A03/MF A01.

See also PB85-101756.

Environmental Radiation Data (ERD) is compiled and contains data from the Environmental Radiation Ambient Monitoring System (ERAMS). The ERAMS is comprised of nationwide sampling stations that provide air, surface and drinking water, and milk samples from which environmental radiation levels are derived. The radiation analyses performed on these samples include gross alpha and gross beta levels, gamma analyses for fission products, and specific analyses for uranium, plutonium, strontium, iodine, radium, krypton, and tritium.

5204 Thermal Effluents Monitoring And Transport

REFER ALSO TO CITATION(S) 26023

5205 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 25317, 26130

5206 Regulations

REFER ALSO TO CITATION(S) 26087

53 ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

5301 Social And Economic Studies

REFER ALSO TO CITATION(S) 25297, 25687, 25690, 26087

26125 **(PB—85-150084/XAB) Alaska OCS (Outer Continental Shelf) social and economic studies program. Technical Report Number 84. Navarin Basin (Sale 83) transportation systems impact analysis. Final report.** Cook, P.; Hennigh, G. (Berger (Louis) and Associates, Inc., Anchorage, AK (USA)). May 1983. 248p. NTIS, PC A11/MF A01.

This report evaluates potential air and marine transportation systems impacts in Unalaska, Cold Bay, St. Paul and St. Matthew Island, and parts of the Alaska Peninsula following the proposed Navarin Basin OCS lease sale (83), scheduled for March 1984. A detailed description of existing and anticipated transportation facilities and services is included for Unalaska/Dutch Harbor, Cold Bay and St. Paul. There is currently no transportation infrastructure on St. Matthew Island. Forecasts of air and marine transportation demands without the economic influence of the lease sale are developed as a base case for comparative analysis. A mean petroleum development scenario prepared by MMS serves as forces of structural change following the lease sale. Forecasts of additional air and marine transportation demands generated by OCS development activities were prepared. Impacts were determined by comparing transportation demands with and without OCS development against existing and anticipated transportation facilities and services.

5302 Assessment Of Energy Technologies

26126 (NP—5901391) Executive summary of draft environmental impact statement for the proposed resource recovery facility at the Brooklyn Navy Yard. (New York City Dept. of Sanitation (USA)). Sep 1984. 85p. City of New York, Dept. of Sanitation, Office of Resource Recovery, 51 Chambers St., Rm 815, New York, NY 10007. File Number TI85901391.

The facility would use mass-burn technology to reduce the volume and weight of municipal solid waste (MSW). By-products of this process would be recovered and marketed. The facility would be able to handle a maximum of 3000 tons per day (tpd) of MSW that would be transported by barge to the site. It would be located at the northern side of the BNY property, adjacent to Kent Avenue. The facility would be developed and constructed by Signal Resco Inc., which would lease the site from the City and develop and operate it commercially for 20 years. Separate analytics have been done for the draft EIS and its appendices. 13 figs., 12 tabs.

26127 (NP—5901392) Draft environmental impact statement for the proposed resource recovery facility at the Brooklyn Navy Yard. (New York City Dept. of Sanitation (USA)). Sep 1984. 292p. City of New York, Dept. of Sanitation, Office of Resource Recovery, 51 Chambers St., Rm 815, New York, NY 10007. File Number TI85901392.

The potential effects of the proposed Brooklyn Navy Yard waste-to-steam project are discussed. The facility would use mass-burn technology to reduce the volume and weight of municipal solid waste (MSW). By-products of this process would be recovered and marketed. The facility would be able to handle a maximum of 3000 tons per day (tpd) of MSW that would be transported by barge to the site. It would be located at the northern side of the BNY property, adjacent to Kent Avenue. The facility would be developed and constructed by Signal Resco Inc., which would lease the site from the City and develop and operate it commercially for 20 years. Separate analytics have been done for the summary and appendices. 300 refs., 32 figs., 45 tabs.

26128 (NP—5901395) Draft Environmental Impact Statement for the proposed resource recovery program at the Brooklyn Navy Yard. Volume III. Technical appendices. Appendix D. Air quality - related issues. (Camp Dresser and McKee, Inc., Boston, MA (USA)). Sep 1984. 412p. City of New York, Dept. of Sanitation, 51 Chambers Street, Room 815, New York, NY 10007. File Number TI85901395.

The potential effects of the proposed Brooklyn Navy Yard waste-to-steam project are examined. The facility would use mass-burn technology to reduce the volume and weight of municipal solid waste (MSW). By-products of this process would be recovered and marketed. The facility would be able to handle a maximum of 3000 tons per day (tpd) of MSW that would be transported by barge to the site. It would be located at the northern side of the BNY property, adjacent to Kent Avenue. The facility would be developed and constructed by Signal Resco Inc., which would lease the site from the City and develop and operate it commercially for 20 years. This appendix addresses air quality concerns of the project. Analytics were done for the DEIS summary, the DEIS, and the other appendices.

5303 Environmental Impact Statements

REFER ALSO TO CITATION(S) 25405, 25406, 25543, 25574

55 BIOMEDICAL SCIENCES, BASIC STUDIES

26129 (PUC-TN—18/82) Some examples of utilization of electron paramagnetic resonance in biology. Bemski, G. (Pontificia Univ. Catolica do Rio de Janeiro (Brazil). Dept. de Fisica). Oct 1982. 79p. NTIS (US Sales Only), PC A05/MF A01. File Number DE85700581.

A short outline of the fundamentals of electron paramagnetic resonance (EPR) is presented and is followed by examples of the application of EPR to biology. These include use of spin labels, as well as of ENDOR principally to problems of heme proteins, photosynthesis and lipids.

5501 Behavioral Biology

26130 Effect of fish size on the reactive distance of bluegill (Lepomis macrochirus) sunfish. Breck, J.E.; Gitter, M.J. (Univ. of Wisconsin, Madison). *Canadian Journal of Fisheries and Aquatic Science;* 40: No. 2, 162-167(1983). Contract W-7405-ENG-26.

We hypothesized that visual acuity in fishes and thus reactive distance should increase with fish size; visual acuity depends on eye lens diameter and cone density in the retina, and eye lens diameter increases with fish size. Though cone density declines in larger fish, we expected this effect to be relatively small. We tested this hypothesis for a behavioral measure of visual acuity, the reactive distance of bluegill (Lepomis macrochirus) sunfish to zooplankton prey, in aquaria (375 L) for fish from 27 to 162 mm standard length. Reactive distance increased nonlinearly with fish size; the rate of increase in reactive distance slows in larger fish. For fish of a given size, reactive distance was dependent on prey size, but visual angle measured from the fish eye was nearly constant. Whereas lens diameter and visual acuity increase with fish size in bluegills, the acuity of larger fish is less than expected from eye lens diameter alone. This is probably a result of cone density decreasing with fish size, as has been found for other fishes. The observed fish-size-dependent differences in reactive distance imply very large differences in visual volumes and encounter rates with prey among size-classes of bluegills. Habitat segregation among bluegill size-classes may prevent the intense intraspecific competition for prey that would be expected, in part, from the superior visual acuity of larger fish. 28 references, 5 figures.

5502 Biochemistry

REFER ALSO TO CITATION(S) 25372, 26146, 26161, 26200

26131 (CBPF-NF—028/82) Hydrogen bond indices and tertiary structure of yeast tRNA sup(Phe). Giambiagi, M.S. de; Giambiagi, M.; Esquivel, D.M.S. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1982. 39p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85700582.

The rigidity and stability of the tertiary structure of yeast tRNA sup(Phe) is related to a bond index employed in an IEHT calculation. The index permits a quantitative estimate of the electronic cloud along the hydrogen bond, having thus an appealing physical meaning. The results indicate that Hoogsteen-type bonds have, as expected, greater electronic population than Watson-Crick type ones. Other non-Watson-Crick pairings, the wobble pair and G_{15}-C_{48}, exhibit high values of the index for the NH...O bond. In the triples, the electronic density of the hydrogen bridges does not weaken, comparing it with the one of the pairs involved. Contour density maps are shown and dipolar moments of pairs and triples are qualitatively discussed.

26132 (DOE/EV/10268—T1) Threshold effects and cellular recognition. Final report, July 1, 1979-March 31, 1984. Rando, R.R. (Harvard Medical School, Boston, MA (USA)). Mar 1985. Contract AC02-79EV10268. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010816.

The studies described here were focussed on the mechanism by which cell surface sugars might be involved in membrane-membrane recognition and adhesion. We initially began our studies by developing new methods to incorporate sugars into membranes. The first, by oxidative coupling technique and the second by incorporating synthetic cholesterol based glycolipids into membranes.

26133 Pyruvate regulation of growth and differentiation in primary cultures of rat tracheal epithelial cells. Wasilenko, W.J.; Marchok, A.C. (Univ. of Tennessee-Oak Ridge Graduate School of Biomedical Sciences). *Experimental Cell Research;* **155**: No. 2, 507-517(Dec 1984). Contract W-7405-ENG-26.

These studies examined the effect of exogenous pyruvate on the growth and differentiation of primary cell cultures of rat tracheal epithelial cells. The cell cultures were derived from outgrowths of tracheal explants, and require pyruvate for survival and growth in the presence of 10% FBS. In pyruvate-supplemented (2 mM) medium, the number of cells attached to the dish increased rapidly, while exfoliation of cells into the medium as well as formation of cornified envelopes were relatively low. The growth response to pyruvate was concentration-dependent in these cell cultures. In the absence of pyruvate, the extent of terminal differentiation to keratinization gradually increased. This was characterized by a cessation of growth after one week, and an increase in exfoliation until all cells had sloughed from the dish. Accompanying these changes was a marked increase in the formation of cornified envelopes. Cells undergoing DNA synthesis were present throughout 2 weeks of culture in pyruvate-deprived medium, even as the total number of cells was diminishing. Several compounds, including other 2-oxocarboxylic acids, were ineffective growth substitutes for pyruvate. These results indicate that the requirement for pyruvate is quite stringent in these cultures and that one pyruvate promotes the growth of tracheal epithelial cells is by inhibiting terminal differentiation.

26134 Charge asymmetry of the purple membrane measured by uranyl quenching of dansyl fluorescence. Renthal, R.; Cha, C.H. (Univ. of Texas, San Antonio). *Biophysical Journal;* **45**: No. 5, 1001-1006(May 1984).

Purple membrane was covalently labeled with 5-(dimethylamino) naphthalene-1-sulfonyl hydrazine (dansyl hydrazine) by carbodiimide coupling to the cytoplasmic surface (carboxyl-terminal tail: 0.7 mol/mol bacteriorhodopsin) or by periodate oxidation and dimethylaminoborane reduction at the extracellular surface (glycolipids: 1 mol/mol). In 2 mM acetate buffer, pH 5.6, micromolar concentrations of UO_2^{2+} were found to quench the dansyl groups on the cytoplasmic surface (maximum = 26%), while little quenching was observed at the extracellular surface (maximum = 4%). Uranyl ion quenched dansyl hydrazine in free solution at much higher concentrations. Uranyl also bound tightly to unmodified purple membrane, (apparent dissociation constant = 0.8 μM) as measured by a centrifugation assay. The maximum stoichiometry was 10 mol/mol of bacteriorhodopsin, which is close to the amount of phospholipid phosphorus in purple membrane. The results were analyzed on the assumptions that UO_2^{2+} binds in a 1:1 complex with phospholipid phosphate and that the dansyl distributon and quenching mechanisms are the same at both surfaces. This indicates a 9:1 ratio of phosphate between the cytoplasmic and extracellular surfaces. Thus, the surface change density of the cytoplasmic side of the membrane is more negative than - 0.010 charges/A^2.

26135 Diffusive properties of water in Artemia cysts as determined from quasi-elastic neutron scattering spectra. Trantham, E.C.; Rorschach, H.E.; Clegg, J.S.; Hazlewood, C.F.; Nicklow, R.M.; Wakabayashi, N. (Rice Univ., Houston, TX). *Biophysical Journal;* **45**: No. 5, 927-938(May 1984). Contract W-7405-ENG-26.

Results have been obtained on the quasi-elastic spectra of neutrons scattered from pure water, 20% agarose gel (hydration four grams H_2O per gram of dry solid) and cysts of the brine shrimp Artemia for hydrations between 0.10 and 1.2 grams H_2O per gram of dry solids. The spectra were interpreted using a two-component model that included contributions from the covalently bonded protons and the hydration water, and a mobile water fraction. The mobile fraction was described by a jump-diffusion correlation function for the translation motion and a simple diffusive orientational correlation function. The results for the line widths $\gamma(Q^2)$ for pure water were in good agreement with previous measurements. The agarose results were consistent with NMR measurements that show a slightly reduced translational diffusion for the mobile water fraction. The Artemia results show that the translational diffusion coefficient of the mobile water fraction was greatly reduced from that of pure water. The line width was determined mainly by the rotational motion, which was also substantially reduced from the pure water value as determined from dielectric relaxation studies. The translational and rotational diffusion parameters were consistent with the NMR measurements of diffusion and relaxation. Values for the hydration fraction and the mean square thermal displacement $<u^2>$ as determined from the Q-dependence of line areas were also obtained.

26136 Chemically induced dynamic nuclear polarization studies of yeast tRNA/sup Phe/. McCord, E.F.; Morden, K.M.; Tinoco, I. Jr.; Boxer, S.G. (Stanford Univ., CA). *Biochemistry;* **23**: No. 9, 1935-1939(24 Apr 1984). Contract AT03-82ER60090.

Chemically induced dynamic nuclear polarization (CIDNP) has been observed from yeast tRNA/sup Phe/ following reaction with photoexcited riboflavin. At 20°C, several resonances of tRNA in the native form show polarization; previous work predicts that only guanosine and its derivatives in single-stranded regions are likely to become polarized. The methyl protons of m_2^2G-26 show strong negative spin polarization, indicating that this residue is accessible. The solvent accessibility of this residue has not been previously demonstrated. In addition, two positively polarized aromatic resonances are observed, which are likely due to two or more G(H8) protons, including those of G-20, m_2^2G-26, and/or Gm-34. For temperatures below 50°C, a negatively polarized signal in the aromatic region is shown to arise from cross relaxation with the methyl group protons of m_2^2G-26. This indicates the proximity of an aromatic proton, probably H2 of A-44, to the methyl groups of m_2^2G-26. At higher temperatures, the CIDNP spectra show polarization of several additional G resonances, including those of m^2G-10. These changes in the CIDNP spectra reflect melting of the tertiary and secondary structure of the tRNA. This work is the first use of CIDNP to study a large nucleic acid molecule and exemplifies the value of this technique in probing single-stranded and solvent-accessible regions of tRNA.

26137 Chemically induced dynamic nuclear polarization studies of guanosine in nucleotides, dinucleotides, and oligonucleotides. McCord, E.F.; Morden, K.M.; Pardi, A.; Tinoco, I. Jr.; Boxer, S.G. (Stanford Univ., CA). *Biochemistry;* **23**: No. 9, 1926-1934(24 Apr 1984). Contract AT03-82ER60090.

The nuclear magnetic resonance (NMR) technique of chemically induced dynamic nuclear polarization (CIDNP) has been used to study the reactions between photoexcited flavins and a wide variety of nucleotides, dinucleotides, and oligonucleotides. The greatest emphasis is placed on the purine nucleosides adenosine (A), inosine (I), and guanosine (G), particularly guanosine. The presence of G suppresses the CIDNP effect for A, although A by itself shows very strong CIDNP. Very intense CIDNP signals are observed for the H8 proton in G-containing mononucleotides, but no nuclear polarization is detected for the sugar H1′ proton. In contrast, both H8 and H1′ protons exhibit CIDNP for G in a wide range of dinucleotides and higher oligonucleotides. Several possible mechanisms are analyzed to explain the H1′ polarization, and it is concluded that the sugar H1′ proton probably obtains spin density through interaction with guanine nitrogen 3. The proximity of the H1′ proton to N3 depends explicity on the glycosidic torsion angle, chi. CIDNP studies of several model compounds in which chi is fixed are consistent with this suggestion. CIDNP for the self-complementary tetramer ApGpCpU was studied as a function of temperature. Strong CIDNP from G is only observed at temperatures above the double-strand melting temperature, suggesting that CIDNP is only detected in single-stranded regions, where the base is accessible to solvent. The use of brominated riboflavin as the photoreagent in place of riboflavin is shown to selectively invert the sign of A, I, and 1-methylguanosine polarization, providing a convenient method for distinguishing the NMR spectra of these residues in complex oligonucleotides.

26138 Phytoalexins and their elicitors - a defense against microbial infection in plants. Darvill, A.G.; Albersheim, P. (Univ. of Colorado, Boulder). *Annual Review of Plant Physiology;* **35**: 243-275(1984). Contract AC02-76ER01426.

Some of the more important evidence is presented which supports the view that accumulation of phytoalexins at the site of attempted infection in plants. The accumulation of phytoalexins represents only one of a number of disease-resistance mechanisms in plants. Experiments are described demonstrating that the enzymes that catalyze the synthesis of phytoalexins are themselves synthesized de novo when plant cells are exposed to microbes of other effective stimuli. Evidence is also presented showing that phytoalexins, once accumulated, are catabolized or detoxified by many microorganisms as well as by the plants themselves. Elicitors are the major concern of this review. The literature is summarized in which elicitors are shown to be not only constituents of some microbes but also to be present in the cell walls of plants. A hypothesis is presented that suggests that all of the abiotic and some of the biotic elicitors stimulate phytoalexin accumulation by causing the release of an endogenous elicitor from the cell walls of plants. 108 references, 9 figures.

26139 **^{13}C-NMR studies of selectively carboxymethylated [methyl-^{13}C]methionine-labeled bacterial dihydrofolate reductase.** London, R.E.; Wageman, W.E.; Blakley, R.L. (Los Alamos National Lab., NM). *FEBS (Federation of European Biochemical Societies) Letters;* **160**: No. 1-2, 56-60(Aug 1983).

The ^{13}C-labeled Streptococcus faecium enzyme was prepared under relatively mild conditions for NMR studies by reaction of unlabeled iodoacetate with the enzyme containing biosynthetically incorporated (methyl-^{13}C]methionine. The compound produced by this unique strategy was used as a part of a continuing study of the enzyme dihydrofolate reductase. The NMR studies provided assignment of resonance data for two of the methionine residues. Additionally, the specificity of the carboxymethylation provides a useful basis for resonance assignment.

26140 **Structure of amphotericin B aggregates based on calculations of optical spectra.** Hemenger, R.P.; Kaplan, T.; Gray, L.J. (Southern California College of Optometry, Fullerton). *Biopolymers;* **22**: 911-918(1983). Contract W-7405-ENG-26.

The degenerate ground state approximation was used to calculate the optical absorption and CD spectra for helical polymer models of amphotericin B aggregates in aqueous solution. Comparisons with experimental spectra indicate that a two-molecule/unit cell helical polymer model is a possible structure for aggregates of amphotericin B.

26141 **Effects of divalent metal ions on the fluorescence and glucose-quenching of yeast hexokinase isozymes.** Feldman, I.; Fame, T. (Univ. of Rochester, NY). *Journal of Inorganic Biochemistry;* **17**: 121-129(1982). Contract AC02-76EV03490.

Titrations of the quenching of the tryptophan fluorescence of yeast isozymes P-I and P-II by Mg^{2+}, Mn^{2+}, Ca^{2+}, Cd^{2+}, and Zn^{2+} ions and by glucose in the presence of each of these ions (10 mM) were performed at pH 5.5 and 6.5 at 20°C. At the higher pH there was a reversal of the type of glucose-binding cooperativity for P-II from negative to positive when either Mn^{2+} or Ca^{2+} was present in the buffered isozyme solution before the glucose titration, whereas Mg^{2+} caused the glucose binding to become noncooperative. Zn^{2+} and Cd^{2+} decreased the glucose quenching of P-II fluorescence drastically at pH 5.5, from a value of 15% in buffer to only 4%. Glucose bindings to the P-I isozyme exhibited positive cooperativity in the presence of either Ca^{2+}, Mg^{2+}, or Mn^{2+}, as well as the buffer alone, at both pH's. At the lower pH, Ca^{2+} enhanced the efficiency of glucose quenching of P-I fluorescence several-fold, while Mn^{2+} increased it only about 40% and Mg^{2+} not at all. The biological implications of these diverse metal ion effects are discussed.

26142 **Pyridine nucleotide metabolism in the erythrocyte of South African blacks with primary hepatoma.** Yeh, Y.K.; Hankes, L.V.; Wessels, L.M. (Brookhaven National Lab., Upton, NY). *Acta Vitaminologica et Enzymologica;* **4**: No. 3, 259-266(1982). Contract AC02-76CH00016.

Erthrocytes from African blacks with primary hepatoma were incubated with physiological amounts of nicotinamide-^{14}C (NM-^{14}C) and it was found that these erythrocytes could synthesize NAD from NM. After 3-hr incubation with NM-^{14}C, a large percentage of the ^{14}C was found in NMN, nicotinamide riboside (NR) and NAD, but was undetectable in nicotinic acid nucleotides (NAMN and NAAD). This suggested that the NAD synthesized from NM was not through the Preiss-Handler pathway. After 6-plus hr incubation, the ^{14}C found in NAMN and NAAD suggested the NAD synthesized was being broken down and reutilized through Preiss-Handler pathway for synthesis of NAD. This reutilization pathway was confirmed by incubating nicotinic acid-^{14}C (NA-^{14}C) with erythrocytes. Apparently the metabolites from the breakdown of NAD were deaminated. The metabolism of NM-^{14}C was slower than NA-^{14}C. However, after 24 hr incubation with NM-^{14}C, 72.26% of ^{14}C was found in NAD. A high percentage of ^{14}C in NR at the initial incubation and a later drop suggested that NR was another intermediate in the pathway.

5503 Cytology

26143 (DOE/ER/60142—2, pp 376-381) **Synchrony for cell transformation.** Bird, R.P.; Abrahamson, B.J. Jul 1984. NTIS, PC A18/MF A01. File Number DE84014885.

In Radiation physics, biophysics and radiation biology. Progress report, December 1, 1983-November 30, 1984.

Cell transformation processes such as cell survival relationships for ionizing radiation may be tested using synchronized cell populations. Work on confluent cell growth techniques and on deficient medium approaches to producing synchrony is reported.

26144 **Kinetics of rouleau formation. II. Reversible reactions.** Samsel, R.W.; Perelson, A.S. (Brown Univ., Providence, RI). *Biophysical Journal;* **45**: No. 4, 805-824(Apr 1984).

Red blood cells aggregate face-to-face to form long, cylindrical, straight chains and sometimes branched structures called rouleaux. Here the authors extend a kinetic model developed by R.W. Samsel and A.S. Perelson to include both the formation and dissociation of rouleaux. Thermodynamic constraints on the rate constants of the model imposed by the principle of detailed balance were examined. Incorporation of reverse reactions allows computation of mean sizes of rouleaux and straight chain segments within rouleaux, as functions of time and at equilibrium. Using the Flory-Stockmayer method from polymer chemistry, a closed-form solution was obtained for the size distribution of straight chain segments within rouleaux at any point in the evolution of the reaction. The predictions of the theory compare favorably with data collected by D. Kernick, A.W.L. Jay, S. Rowlands, and L. Skibo on the kinetics of rouleaux formation. When rouleaux grow large, they may contain rings or loops and take on the appearance of a network. The importance of including the kinetics of ring closure in the development of realistic models of rouleaux formation was demonstrated.

26145 **Microspectrofluorometry by digital image processing: measurement of cytoplasmic pH.** Tanasugarn, L.; McNeil, P.; Reynolds, G.T.; Taylor, D.L. (Carnegie-Mellon Univ., Pittsburgh, PA). *Journal of Cell Biology;* **98**: No. 2, 717-724(Feb 1984). Contract AC02-76EV03120.

An interface of our microspectrofluorometer with an image processing system performs microspectrofluorometric measurements in living cells by digital image processing. Fluorescence spectroscopic parameters can be measured by digital image processing directly from microscopic images of cells, and are automatically normalized for pathlength and accessible volume. Thus, an accurate cytoplasmic map of various spectroscopic parameters can be produced. The resting cytoplasmic pH of fibroblasts (3T3 cells) has been determined by measuring the ratio of fluorescein fluorescence exited by two successive wavelengths (489 and 452 nm). Fluorescein-labeled dextran microinjected into the cells is used as a pH indicator, since it is trapped in the cytoplasm but is excluded from the nucleus and other organelles. The average cytoplasmic pH is 6.83 (+/- 0.38). However, cytoplasmic pH exhibits a non-unimodal distribution, the lower mean pH being 6.74 (+/- 0.23). When 3T3 cells pinocytose medium containing fluorescein dextran, pinosomes peripheral to the nucleus exhibit a lower pH than those closer to the ruffling edge of the cell. The present image processing system is

analyzed for linearity of detection, light scattering artifacts, signal to noise ratio, standard curves, and spatial resolution. The results obtained from digital image analysis are shown to be comparable to the results from standard microspectrofluorometry. We also discuss several other applications of this ratio imaging technique in cell biology.

26146 **Modulation of secreted proteins of mouse mammary epithelial cells by the collagenous substrata.** Lee, E.Y.H.; Parry, G.; Bissell, M.J. (Lawrence Berkeley Lab., CA). *Journal of Cell Biology;* **98**: No. 1, vp(Jan 1984). Contract AC03-76SF00098.

It has been shown previously that cultures of mouse mammary epithelial cells retain their characteristic morphology and their ability to produce γ-casein, a member of the casein gene family, only if they are maintained on floating collagen gels. In this paper we show: (a) Cells on floating collagen gels secrete not only γ-casein but also α_1-, α_2-, and β-caseins. These are not secreted by cells on plastic and are secreted to only a very limited extent by cells on attached collagen gels. (b) The floating collagen gel regulates at the level of synthesis and/or stabilization of the caseins rather than at the level of secretion alone. Contraction of the floating gel is important in that cells cultured on floating glutaraldehyde cross-linked gels do not secrete any of the caseins. (c) The secretion of an 80,000-mol-wt protein, most probably transferrin, and a 67,000-mol-wt protein, probably butyrophilin, a major protein of the milk fat globule membrane, are partially modulated by substrata. However, in contrast to the caseins, these are always detectable in media from cells cultured on plastic and attached gels. (d) Whey acidic protein, a major whey protein, is actively secreted by freshly isolated cells but is secreted in extremely limited quantities in cultured cells regardless of the nature of the substratum used. Lactalbumin secretion is also decreased significantly in cultured cells. (e) A previously unreported set of proteins, which may be minor milk proteins, are prominently secreted by the mammary cells on all substrata tested. We conclude that while the substratum profoundly influences the secretion of the caseins, it does not regulate the expression of every milk-specific protein in the same way. The mechanistic implications of these findings are discussed.

26147 **Effect of receptor clustering on diffusion-limited forward rate constants.** Goldstein, B.; Wiegel, F.W. (Los Alamos National Lab., NM). *Biophysical Journal;* **43**: 121-125(Jul 1983).

The effect of receptor clustering on the diffusion-limited forward rate constant (k/sub +/) is studied theoretically by modeling cell surface receptors by hemispheres distributed on a plane. The authors give both exact results and bounds. The exact results are obtained using an electrostatic analogue and applying the method of the images. Accurate upper bounds on K/sub +/ are found from a variational principle.

26148 **Method for rapid, continuous monitoring of solute uptake and binding.** Gruner, S.M.; Kirk, G.; Patel, L.; Kaback, H.R. (Joseph Henry Laboratories, Princeton, NJ). *Biochemistry;* **21**: No. 13, 3239-3243(1983). Contract AC02-76EV03120.

A method has been developed for dynamically monitoring the free concentration diffusible, tritated solutes. The technqiue utilizes particles of a solid scintillator microencapsulated in gel beads that are permeable to diffusible label. Since tritium β radioactivity has an effective range in water of only a few micrometers, only label that is free to diffuse through the gel can excite the scintillator, while sequestered label is effectively excluded. Thus, the scintillation light output monitors the freely diffusible concentration of label exclusively. A simple, preliminary encapsulation technique is described and tested, and the theory behind the method is discussed with regard to the time resolution attainable for a given label concentration and type of encapsulation. The feasibility of the method is demonstrated by measuring the uptake of [^{3}H]tetraphenylphosphonium by Escherichia coli membrane vesicles in response to the generation of a membrane potential (interior negative).

26149 **Direct evidence for anti-tumor activity by NK cells in vivo: growth of B16 melanoma in anti-NK 1.1-treated mice.** Pollack, S.B. (Univ. of Washington School of Medicine, Seattle). pp 1347-1352 of NK cells and other natural effector cells. New York, NY; Academic Press, Inc. (1982). Contract AT06-79EV10270.

Previous studies from a number of laboratories have indicated that in vivo tumor resistance varies with the level of natural killer cell activity. A model to directly test the role of natural killer cells in vivo was used on the growth of a solid tumor, the B16 melanoma, in B6 mice. Results indicate that B16 grew significantly faster in beige than in normal control mice. These results strengthen the conclusion that the enhanced growth of B16 in beige mice is due to their inherent natural killer deficiency. Depletion of natural killer cells in B6 mice with one injection of antiserum allowed significantly greater tumor growth. 6 references, 2 figures.

5504 Genetics

REFER ALSO TO CITATION(S) 25419, 26161, 26190, 26201, 26215

26150 **(DOE/EV/01300—49) Organization of the R region in maize. Annual progress report.** Kermicle, J. (Wisconsin Univ., Madison (USA). Lab. of Genetics). Apr 1985. Contract AC02-76EV01300. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85011273.

This progress report is comprised of 5 summaries of manuscripts devoted to investigations of the behavior of transposable insertion sequences, unusual recombinational events, and alternative means of assessing genetic homology.

26151 **(EUR—9322-EN) Molecular genetics of the chloroplast of "Chlamydomonas reinhardtii".** Bennoun, P.; Girard, J.; Masson, A.; Delepelaire, P.; Wollman, F.A. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1984. 59p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

The authors have carried out a molecular and genetic analysis of the chloroplast ATPase in 'Chlamdydomonas reinhardtii'. Recombination and complementation studies on 16 independently isolated chloroplast mutations affecting this complex demonstrated that they represent alleles in five distinct chloroplast genes. Both whole and broken-cell preparations of the mutant alga show a resistance to the effects of herbicide on electron transfer, as measured by fluorescence induction kinetics. In the absence of herbicide, mutant cells exhibit a slower rate of electron transfer than do wild-type cells.

26152 **Food as a limiting factor and selective agent for genic heterozygosity in the cotton mouse Peromyscus gossypinus.** Smith, M.W.; Teska, W.R.; Smith, M.H. (Savannah River Ecology Lab., Aiken, SC). *American Midland Naturalist;* **112**: No. 1, 310-323(Jul 1984). Contract AC09-76SR00819.

Supplemental food was added to six of 12 1-ha grids for 14 months. At the end of this time, there were approximately 3.5 times as many cotton mice on the areas receiving food than on the control areas. The direct and/or indirect effects of food was limiting to population number on the control areas, and its lower availability apparently selected for increased heterozygosity at the esterase-1 (EST-1) locus. EST-1 may be an indicator of overall heterozygosity and animals which are more heterozygous may be better competitors for the limited food resource. The lack of significant effects on the other two variable loci and the slight possibility of a null allele at EST-1 lowers our confidence in this hypothesis. However, some sort of selection was operating in these populations. 43 references, 1 figure, 2 tables.

5506 Medicine

REFER ALSO TO CITATION(S) 25902, 26163, 26428

26153 (AD-A—150646/8/XAB) Three image experts which help distinguish lung tumors from non-tumors. Technical report. Lampeter, W. (Rochester Univ., NY (USA). Dept. of Computer Science). Feb 1984. 13p. (TR—123). NTIS, PC A02/MF A01.

The design of three vision-expert programs is described. The vision experts are based on appearance models of objects in a typical chest radiograph which were derived using information from human experts. Each expert is based on a different technical concept. The rib expert uses relational constraints on parameter (Hough transform) space to determine if a rib has been detected; the vascularity expert uses a back-projected Hough transform; and the nodule expert uses features which were derived from studies of the nodule recognition process of radiologistics. The efficacy of the descriptive models and their implementations are evaluated. The process of development and implementation of image experts are discussed.

26154 (AD-A—150940/5/XAB) Design, tuning, and performance evaluation of an automated pulmonary nodule detection system. Technical report. Lampeter, W. (Rochester Univ., NY (USA). Dept. of Computer Science). Feb 1983. 96p. (TR—120). NTIS, PC A05/MF A01.

Sponsored in part by Grant PHS-5R01-HL21253-05.

Radiologists miss approximately 25-30% of all pulmonary nodules smaller than 1.0 cm. in mass screenings. This paper describes a system for the automated detection of pulmonary nodules. It aids the radiologist by indicating the sites in the radiograph most likely to be nodules. Procedurally-driven image experts that respond to specific types of anatomic features are incorporated in a pattern recognizer which uses linear discriminant analysis to classify the candidate nodule sites. Sites not classified as nodules are eliminated from the list of sites presented to the radiologist for inspection. This system has been tested on 43 chest radiographs, and has demonstrated that pattern recognition techniques and procedurally-driven image experts are capable of reducing the number of sites that a radiologist for inspection. This system has been tested on 43 chest radiographs, and has demonstrated that pattern recognition techniques and procedurally-driven image experts are capable of reducing the number of sites that a radiologist must inspect from at most 17 to at most 3 in order to be 99% confident of having inspected any nodule detected by the system that is trained with 37 films.

26155 (DOE/ER/60142—2, pp 358-364) **Radiobiological studies with high energy neutrons used for radiotherapy.** Hall, E.J.; Astor, M.B.; Bird, R.P.; Brenner, D.J. Jul 1984. NTIS, PC A18/MF A01. File Number DE84014885.

In Radiation physics, biophysics and radiation biology. Progress report, December 1, 1983-November 30, 1984.

Changes in relative biological effectiveness (RBE) with depth for the Fermilab neutron therapy beam were investigated using Chinese hamster V79 cells and a human skin fibroblast line AG1522. RBE changes with depth were noted which need to be taken into account when the beam is used clinically.

26156 (PB—85-154128/XAB) Research, development and evaluation of minimally invasive systems for detection and quantification of atherosclerotic lesions in coronary arteries in humans. Annual report No. 1, 30 September 1983-29 May 1984. Sashin, D. (Pittsburgh Univ., PA (USA)). 26 Jul 1984. 26p. NTIS, PC A03/MF A01.

The present report describes the first eight months of research, development and evaluation of an advanced dual x-ray beam technique for diode-array digital radiography designed to achieve a minimally invasive detection and quantification of atherosclerotic lesions in the coronary artery. The improved and novel system presently being developed uses a dual anode x-ray source to produce two electrical charge images in two sets of self-scanning linear diode arrays that are fiber-optically coupled to parallel narrow strips of phosphor screen. The output of the arrays is then digitally stored, processed and displayed over a high bandwidth television monitor presenting a visual image of the coronary arteries containing relatively low amounts of radiographic contrast media such as can be readily produced by minimally invasive intravenous injection. In this manner, a minimally invasive technique of visualizing small coronary vessels should be attainable.

26157 (PB—85-937600/XAB) Cancer detection and management: nuclear medicine. Cancergram CT02. (National Cancer Inst., Bethesda, MD (USA). International Cancer Research Data Bank). 1985. v, 12 issuesp. Paper copy available on subscription, North American Continent price $30.00/year; all others write for quote. Also available in single copies.

Supersedes PB84-937600.

The Cancergram covers all aspects of the clinical use of radionuclides or nuclear medicine techniques in the care of cancer patients. It also includes any preclinical studies of various radionuclides or techniques considered to have direct clinical diagnostic relevance. Other basic biologic, pharmacologic, or metabolic studies where radionuclides are used as tracers will generally be excluded. Radiotherapy is covered by Cancergram CT15, and Diagnostic Radiology by Cancergram CT14.

26158 (PB—85-939000/XAB) Clinical treatment of cancer: radiation therapy. Cancergram CT15. (National Cancer Inst., Bethesda, MD (USA). International Cancer Research Data Bank). 1985. v, 12 issuesp. Paper copy available on subscription, North American Continent price $30.00/year; all others write for quote. Also available in single copies.

Supersedes PB84-939000.

This Cancergram covers all forms of radiotherapy being used in the treatment of cancer, including standard x-ray, cobalt 60 and radium irradiation as well as high linear energy transfer (LET), megavoltage, electron beam treatment, and radioactive interstitial implants. Coverage of this topic includes adverse effects of radiotherapy, radiocurability, radiodosimetry, radiosensitization, and study with specialized instrumentation such as the betatron and linear accelerator. Radiobiology, animal experiments, tissue culture experiments, carcinogenesis, and other preclinical studies will not be included except for those considered to have direct clinical relevance.

26159 (PB—85-939100/XAB) Cancer detection and management: diagnostic radiology. Cancergram CT14. (National Cancer Inst., Bethesda, MD (USA). International Cancer Research Data Bank). 1985. v, 12 issuesp. Paper copy available on subscription, North American Continent price $30.00/year; all others write for quote. Also available in single copies.

Supersedes PB84-939100.

The Cancergram covers the field of diagnostic radiology from amniography to xerography in all of its clinical applications. It also includes such closely related techniques as fluoroscopy, ultrasonography, and thermography. Areas of interest are the clinical applications of these techniques, instrumentation, comparative studies, and any preclinical studies that have direct clinical relevance. Radiation therapy, or the use of radioactive isotopes and other nuclear medicine techniques, are not in scope, as they are covered by Cancergrams CT15 and CT02, respectively.

5507 Microbiology

REFER ALSO TO CITATION(S) 25372, 25375, 26091, 26136, 26151, 26215, 26216

26160 (CBPF-NF—039/82) Magnetostatic microorganisms of the Rio de Janeiro region. Esquivel, D.M.S.; Barros, H.G.deP.L. de; Danon, J.; Farina, M.; Aragao, P.H.A. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1982. 21p. (In French). NTIS (US Sales Only), PC A02/MF A01. File Number DE85700596.

The observational results in optical and electronic microscopy of the magnetostatic microorganisms (Chlamydomona and coccus) found in the Rio de Janeiro waters, Brazil, are presented.

26161 **Comparative physicochemical and biological properties of two strains of Kilham rat virus, a non-defective parvovirus.** Mitra, S.; Snyder, C.E.; Bates, R.C.; Banerjee, P.T. (Oak Ridge National Lab., TN). *Journal of General Virology;* 61: 43-54(1982). Contract W-7405-ENG-26.

Two antigenically indistinguishable strains, 171 and 308, of Kilham rat virus (KRV) have distinct host ranges and contain capsid proteins of identical size, but with different isoelectric points. The single-stranded DNA genomes of the viruses are also the same size but appear to have different secondary and tertiary structures. The genomes of the two strains have nearly identical cleavage maps for 11 restriction endonucleases. However, there is a lack of extended heteroloy in the nucleotide sequence of the two virus genomes, as judged by electron microscopic analysis of the heteroduplex of the two virus DNAs. This suggests that very subtle differences in the sequences of the genome, and possibly of the capsid proteins, may play a role in the host specificity without affecting the antigenic similarity of KRV strains.

5509 Pathology

26162 (ORNL—6119, pp 129-156) **Cancer section.** Fry, R.J.M. Jan 1985. NTIS, PC A10/MF A01. File Number DE85005663.

In Biology Division progress report, October 1, 1983-September 30, 1984.

An overview is presented of the program at ORNL which is concerned with the study of cancer. The studies range from those at the molecular level and the control of gene expression to those concerning cell interactions and the role of immune responses. Since the agents capable of inducing cancer are multiple, the approaches must encompass the specific characteristics of chemical carcinogens, ionizing radiation, ultraviolet radiation and viruses. The approach of the molecular biological studies is centered on the role of activation of transposable gene elements. One investigation is concerned with the study of radiation-induced myelogenous leukemia. The other radiation carcinogenesis studies fall into two major groups. First, there are investigations of various facets of the mechanisms of cancer induction. The molecular and chromosomal studies fall into this category. The second group of studies includes those that are concerned with risk estimates.

26163 **(PB—85-937900/XAB) Lymphomas: diagnosis, treatment. Cancergram CT05.** (National Cancer Inst., Bethesda, MD (USA). International Cancer Research Data Bank). 1985. v, 12 issuesp. Paper copy available on subscription, North American Continent price $30.00/year; all others write for quote. Also available in single copies.

Supersedes PB84-937900.

The scope of this Cancergram includes Hodgkin's disease, adenolymphoma, Burkitt's lymphoma, lymphosarcoma, lymphoblastoma, lymphocytoma, reticulum cell sarcoma, mycosis fungoides, and any not otherwise specified lymphoma. Abstracts are included which concern all clinical aspects of the various forms of lymphoma, such as diagnosis and staging, supportive care, evaluation, and therapy. Animal models, tissue culture experiments, carcinogenesis and other preclinical studies are generally excluded, except for those considered to have direct clinical relevance.

26164 **Epidemiologic programs for computers and calculators: use of Poisson regression models in estimating incidence rates and ratios.** Frome, E.L.; Checkoway, H. (Oak Ridge National Lab., TN). *American Journal of Epidemiology;* 121: No. 2, 309-323(Feb 1985). Contract AC05-76OR00033;W-7405-ENG-26.

Summarizing relative risk estimates across strata of a covariate is commonly done in comparative epidemiological studies of incidence or mortality. Conventional Mantel-Haenszel and rate standardization techniques used for this purpose are strictly suitable only when there is no interaction between relative risk and the covariate, and tests for interaction typically are limited to examination for departures from linearity. Poisson regression modeling offers an alternative technique which can be used for summarizing relative risk and for evaluating complex interactions with covariates. A more general application of Poisson regression is its utility in modeling disease rates according to postulated etiologic mechanisms of exposures or according to disease expression characteristics in the population. The applications of Poisson regression analysis to problems of summarizing relative risk and disease rate modeling are illustrated with examples of cancer incidence and mortality data, including an example of nonlinear model predicted by the multistage theory of carcinogenesis. 34 references, 2 figures, 7 tables.

26165 **Recognition and invasion of human erythrocytes by malarial parasites: contribution of sialoglycoproteins to attachment and host specificity.** Friedman, M.J.; Blankenberg, T.; Sensabaugh, G.; Tenforde, T.S. (Univ. of California, San Francisco). *Journal of Cell Biology;* 98: No. 5, 1672-1677(May 1984). Contract AC03-76SF00098.

The receptivity of human erythrocytes to invasion by Plasmodium falciparum merozoites can be decreased by neuraminidase or trypsin treatment, an observation that supports a role for the erythrocyte sialoglycoproteins (glycophorins) in invasion. We have found that α_1-acid glycoprotein (AGP), added to in vitro cultures, can restore invasion of enzyme-treated human erythrocytes. AGP is structurally different from the glycophorins although it does carry 12% sialic acid. Its ability to restore receptivity to desialylated cells is dependent on its sialic acid complement, its concentration, and its binding to the erythrocyte surface. We present evidence that AGP forms a bridge between the merozoite and the enzyme-treated erythrocyte that allows the stronger and more complex interactions of invasion to proceed. We suggest that the glycophorins play the same role on the surface of the intact erythrocyte. 31 references, 3 figures, 6 tables.

5510 Physiological Systems

REFER ALSO TO CITATION(S) 26138

26166 **(AD-A—150191/5) Biophysical discussions: ionic channels in membranes held at Airlie, Virginia on 2-5 October 1983.** (Biophysical Society, Bethesda, MD (USA)). 5 Oct 1983. 372p. Rockefeller Univ. Press, 1230 York Ave., New York, NY 10021. HC $18.50, 12 Volumes $220.00 (No copies furnished by DTIC/NTIS).

Partial contents include: Light-activated channels in limulus ventral photoreceptors; Paramagnetic hydrophobic ions as probes for electrically active conformational transitions in Ion channels; Acetylcholine receptor. Dynamic properties; Acetylcholine-activated channel current-voltage relations in symmetrical Na(+) solutions; A molecular model for an acetylcholine binding site. Ion channel and the bilayer helices of the acetylcholine receptor assigned using single group rotation theory and electrostatic interactions; Effects of halothane on the acetylcholine receptor channel in cultured xenopus myocytes; Deuterium oxide effects frog endplate channels; Activation and inactivation kinetics or torpedo Californica acetylcholine receptor in reconstituted membranes; Acetylcholine-induced K(+) current in amphibian atrial cells; Functional reconstitution of rat striatal dopamine agonist receptors into artificial lipid bimolecular membranes; Blocking kinetics at excitatory acetylcholine responses on Aplysia Neurons; The secondary structure of Acetycholine receptor reconstituted in a single lipid component as determined by raman spectroscopy; Molecular and cellular mapping of the voltage-dependent Na(+) channel.

5520 Public Health

REFER ALSO TO CITATION(S) 25519

5530 Agriculture And Food Technology

REFER ALSO TO CITATION(S) 25774, 25777, 26093, 26094

26167 (CONF-8303106—, pp 505-518) **Sewage sludge as a fertilizer.** Kloke, A. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE85770201.

From 16. Essen meeting on sewage sludge - raw material or pollutant; Essen, F.R. Germany (9 Mar 1983).

The employment of sewage sludge in agriculture is not only the cheapest method of waste elimination - as compared to deposition, incineration and dumping from barges - but also the most useful. It is an authentic re-use of plant nutrients, which are returned to the soil via foodstuffs, animals and humans. The positive effects of sewage sludge fertilization on soil and crop are presented with the help of some examples.

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

REFER ALSO TO CITATION(S) 26160

26168 **(AD-A—149658/7/XAB) Synthesis of new prophylactic antiradiation drugs. Annual report, 1 August 1983-31 July 1984.** Bauer, L. (Illinois Univ., Chicago (USA). Medical Center). Aug 1984. 64p. NTIS, PC A04/MF A01.

Syntheses of 1-amino-2-(1-phenyl-2-adamantyl)ethane, (1-phenyl-4-adamantyl)-methylamine and 1-amino-2- 4-(1-adamantylphenyl) ethane and their transformation to the disulfides of the corresponding 2-mercaptoacetamidines are described. 4-Epoxymethyleneprotoadamantane was converted in 2 steps to 2-phenyl-1-adamantanecarboxylic acid, a precursor for the planned synthesis of (2-phenyl-1-adamantyl)alkylamines.

26169 **(ANL—84-103-Pt.2) Environmental Research Division annual report: Center for Human Radiobiology, July 1983-June 1984. Part 2.** (Argonne National Lab., IL (USA)). Apr 1985. Contract W-31-109-ENG-38. 200p. NTIS, PC A09/MF A01; GPO Dep. File Number DE85011174.

Epidemiological studies of the late effects of internal radium in man, and mechanistic investigations of those effects, have continued. The current status of the study is summarized. An experimental technique for preparing thin sections of bone and the application of that technique in studying the comparative distribution of radium and plutonium are described. Radiological dental changes due to radium in man and dog are compared. Survival of human fibroblasts irradiated with alpha particles in vitro was found to be higher when the average LET was higher. In the study of the late effects of thorium in man, the relative activities of the daughter products in the lung have been determined spectrometrically in vivo. The exhalation of thoron in these persons has been investigated in relation to lung burden of thorium and to personal factors such as smoking, age, and weight. The administration of two isotopes to large mammals has been used to demonstrate that the metabolism of plutonium is independent of route of entry and to determine the gastrointestinal absorption of plutonium. The effect of thermoluminescence on a scintillation radon counting system has been investigated quantitatively. Data on the exposure of 88 persons to radium were added to the data base, bringing the total to 2400 radium cases under study by the Center for Human Radiobiology. Separate abstracts were prepared for individual papers.

26170 (DOE/ER/60142—2, pp 123-141) **Study of cell survival in mammalian cells exposed to spatially correlated triads of protons.** Zaider, M.; Bird, R.P.; Rossi, H.H.; Marino, S. Jul 1984. NTIS, PC A18/MF A01. File Number DE84014885.

In Radiation physics, biophysics and radiation biology. Progress report, December 1, 1983-November 30, 1984.

Experimental results on the survival of Chinese hamster V9 cells exposed to a triatomic hydrogen ion beam are reported and interpreted in the framework of the Theory of Dual Radiation Action (TDRA). The results show that the process of lesion formation depends strongly on the relative separations of energy deposition events in the irradiated field.

26171 (DOE/ER/60142—2, pp 142-150) **Analysis of V79 survival data following simultaneous or sequential irradiation by 15-MeV neutrons and ^{60}Co photons.** Zaider, M.; Brenner, D.J. Jul 1984. NTIS, PC A18/MF A01. File Number DE84014885.

In Radiation physics, biophysics and radiation biology. Progress report, December 1, 1983-November 30, 1984.

Survival data from simultaneous and sequential irradiation of V79 Chinese hamster cells by 15-MeV neutrons and ^{60}Co photons are interpreted based on synergism and sublethal damage repair effects.

26172 (DOE/ER/60142—2, pp 212-231) **Radiobiological studies with a series of human cell lines of varying glutathione content.** Astor, M.B. Jul 1984. NTIS, PC A18/MF A01. File Number DE84014885.

In Radiation physics, biophysics and radiation biology. Progress report, December 1, 1983-November 30, 1984.

Radiation responses of a series of four human fibroblast lines obtained from a family affected with 5-oxoprolinuria were determined. Cell suspensions were irradiated under hypoxic conditions and the oxygen enhancement ratio was determined for each cell line. Results are compared with previous studies.

26173 (DOE/ER/60142—2, pp 232-245) **Comparison of misonidazole sensitizing efficiency in GSH deficient human fibroblasts and BSO treated V79 cells.** Astor, M.B.; Hall, E.J.; Hartog, B. Jul 1984. NTIS, PC A18/MF A01. File Number DE84014885.

In Radiation physics, biophysics and radiation biology. Progress report, December 1, 1983-November 30, 1984.

Radiation survival curves for gluththione deficient human fibroblasts cultured in vitro were taken to investigate the role that glutathione and total cellular non-protein thiols play in the radiosensitivity of aerated and hypoxic cells. The role that cellular thiols play in the effectiveness of misonidazole as a radiosensitizer was examined. The results are compared with previous studies using BSO for thiol depletion.

26174 (DOE/ER/60142—2, pp 246-257) **Effects of D,L-Buthionine-S,R-sulfoximine on cellular thiol levels and the oxygen effect in Chinese hamster V79 cells.** Astor, M.B.; Hall, E.J.; Hartog, B. Jul 1984. NTIS, PC A18/MF A01. File Number DE84014885.

In Radiation physics, biophysics and radiation biology. Progress report, December 1, 1983-November 30, 1984.

Cellular glutathione and non-protein thiols were removed from Chinese hamster V79 cells cultured in vitro by using a specific enzyme inhibitor, D,L-Buthionine-S,R-sulfoximine. The resultant effects on aerated and hypoxic cell radiosensitivity were studied.

26175 (DOE/ER/60142—2, pp 258-279) **Inhibition of radiation and chemically induced transformation in vitro by inhibitors of poly(ADP-ribose) synthesis.** Borek, C.; Cleaver, J.E. Jul 1984. NTIS, PC A18/MF A01. File Number DE84014885.

In Radiation physics, biophysics and radiation biology. Progress report, December 1, 1983-November 30, 1984.

Poly(ADP-ribose) is an important cellular regulatory molecule which may be important in cell transformation and mutagenesis. The effects of 3-aminobenzamide (3 AbzA) and benzamide (B_2A) inhibitors on poly(ADP-ribose) synthesis and in cell transformation by a variety of DNA-damaging agents were studied.

26176 (DOE/ER/60142—2, pp 280-291) **Oncogenic transformation of human cells by ultraviolet radiation.** Borek, C.; Andrews, A.D. Jul 1984. NTIS, PC A18/MF A01. File Number DE84014885.

In Radiation physics, biophysics and radiation biology. Progress report, December 1, 1983-November 30, 1984.

In vitro cultures of human fibroblast cells from subjects with xeroderma pigmentosum or Bloom syndrome were irradiated with 280-320 nm ultraviolet radiation and studied for oncogenic transformations.

26177 (DOE/ER/60142—2, pp 292-304) **Paraquat and radiation effects on mouse C_3H 10T1/2 cells.** Geard, C.R.; Shea, C.M.; Georgsson, M.A. Jul 1984. NTIS, PC A18/MF A01. File Number DE84014885.

In Radiation physics, biophysics and radiation biology. Progress report, December 1, 1983-November 30, 1984.

The effects of paraquat on cellular lethality, cytokinetics, oncogenic transformation and chromosomal changes in mouse C_3H 10T1/2 cells were examined alone and in combination with ionizing radiation. Survival curves and oncogenic transformation and mitosis histograms are presented.

26178 (DOE/ER/60142—2, pp 323-334) **Asbestos, radiation and oncogenic transformation.** Hei, T.K.; Osmak, R.S.; Shang, Y.Y.; Hall, E.J. Jul 1984. NTIS, PC A18/MF A01. File Number DE84014885.

In Radiation physics, biophysics and radiation biology. Progress report, December 1, 1983-November 30, 1984.

The effects of the interaction between asbestos and γ-radiation on cytotoxicity and oncogenic transformation were studied in C_3H 10T1/2 mouse embryo fibroblasts in vitro. Some conclusions on synergism in asbestos carcinogenicity are discussed.

26179 (DOE/ER/60142—2, pp 335-348) **Effects of cellular non-protein sulfhydryl depletion in radiation induced oncogenic transformation and genotoxicity in mouse C_3H 10T1/2 cells.** Hei, T.K.; Geard, C.R.; Hall, E.J. Jul 1984. NTIS, PC A18/MF A01. File Number DE84014885.

In Radiation physics, biophysics and radiation biology. Progress report, December 1, 1983-November 30, 1984.

Cellular non-protein sulfhydryl levels in C_3H 10T1/2 mouse embryo fibroblast cell cultures were depleted under aerated conditions using BSO and the cultures were subsequently exposed to γ-radiation. The effects of NPSH depletion alone or in conjuction with radiation on cytotoxicity, oncogenic transformation, chromosomal alterations and cytokinetics were examined.

26180 (DOE/ER/60142—2, pp 349-357) **Potentially lethal damage repair in human AG1522 fibroblasts in plateau phase under acute and low dose rate ^{137}Cs irradiation.** Minarik, L.; Marchese, M. Jul 1984. NTIS, PC A18/MF A01. File Number DE84014885.

In Radiation physics, biophysics and radiation biology. Progress report, December 1, 1983-November 30, 1984.

Radiobiological survival parameters of normal human diploid fibroblast in vitro were examined in an attempt to determine their capability for potentially lethal damage repair. The findings on PLDR effect vs. dose rates are discussed.

26181 (DOE/ER/60142—2, pp 365-375) **Track segment studies with Chinese hamster cells.** Bird, R.P. Jul 1984. NTIS, PC A18/MF A01. File Number DE84014885.

In Radiation physics, biophysics and radiation biology. Progress report, December 1, 1983-November 30, 1984.

Survival curves of near-diploid and near-tetraploid Chinese hamster cell cultures following irradiation by an ^{241}Am α source indicate different growth rates for the two clones. Possible reasons for the difference are discussed.

26182 (DOE/ER/60142—2, pp 382-393) **Potentially lethal damage repair in cell lines of radioresistant human malignant tumor origin.** Marchese, M.J.; Minarik, L. Jul 1984. NTIS, PC A18/MF A01. File Number DE84014885.

In Radiation physics, biophysics and radiation biology. Progress report, December 1, 1983-November 30, 1984.

Survival curves following irradiation were made for three radioresistant tumor cell lines, two of melanoma origin and one osteosarcoma line. The data were analyzed for potentially lethal damage repair effects and compared with other PLDR studies.

26183 (NUREG/CR—4033) **Role of personal air sampling in radiation safety programs and results of a laboratory evaluation of personal air-sampling equipment.** Ritter, P.D.; Huntsman, B.L.; Novick, V.J.; Alvarez, J.L.; Rich, B.L. (EG and G Idaho, Inc., Idaho Falls (USA)). Dec 1984. Contract AC07-76ID01570. 76p. (EGG—2352). NTIS, PC A05/MF A01 - GPO. File Number TI85011276.

Recommended applications for personal air sampling in NRC licensee radiation protection programs are presented. The recommendations are based on performance tests of currently available samplers, a review of research and regulatory literature, and a survey of current licensee air-sampling programs. The performance tests show that personal air samplers are available which can provide a reliable, convenient means for breathing-zone sampling of workers in practically any work environment which might be encountered in the licensee industries. The research literature emphasized that estimates of an individual's exposure may be greatly underestimated if based on general area air samples, as is common practice in current licensee programs, due to the unpredictable variability of airborne-activity concentrations in the worksite. Research concerning the applicability of air-sampling measurements for estimating intake, uptake, and internal dose was also reviewed. These studies indicate that although breathing-zone activity measurements might provide the best (although not always accurate) means to estimate intake, estimates of uptake and internal dose usually should be made with bioassay or whole body counting. Other information on practical aspects of personal air sampling and related exposure control efforts are presented in the report. 27 refs., 15 figs., 18 tabs.

26184 **(PB—85-935500/XAB) Radiation carcinogenesis. Cancergram CK06.** (National Cancer Inst., Bethesda, MD (USA). International Cancer Research Data Bank). 1985. v, 12 issuesp. Paper copy available on subscription, North American Continent price $30.00/year; all others write for quote. Also available in single copies.

Supersedes PB84-935500.

The Cancergram deals with all aspects of radiation carcinogenesis. The term 'radiation' here includes U-V radiation and the entire electromagnetic spectrum, electron and other charged particle beams, neutrons and alpha and beta radiation from radioactive substances. Abstracts included concern relationships between radiation and carcinogenesis in humans, experimental induction of tumors in animals by irradiation, studies on the mechanism of radiation carcinogenesis at the cellular level, studies of RBE, dose response or dose threshold in relation to radiation carcinogenesis, and methods and policies for control of radiation exposure in the general population. In general, this Cancergram excludes abstracts on radiotherapy, radiologic diagnosis, radiation pathology, and radiation biology, where these articles have no bearing on radiation carcinogenesis.

26185 **(UCRL—91593) Mouse oocyte killing by neutrons: target considerations.** Straume, T.; Dobson, R.L. (Lawrence Livermore National Lab., CA (USA)). Apr 1985. Contract W-7405-ENG-48. 10p. (CONF-850506—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85011362.

From 9. symposium on microdosimetry; Toulouse, France (20 May 1985).

Highly radiosensitive primordial mouse oocytes, the principal cells at genetic risk in the female, have been studied using 0.43-MeV neutrons. Analysis of the survival curve (D_{37} = 0.055 Gy) indicates that the diameter of the radiosensitive target (assumed spherical and of unit density) is larger than that of the nucleus but not of the oocyte, implicating a non-nuclear but sub-cellular target. This is consistent with results from ^3H-thymidine incorporated in DNA. Our efforts to identify the extraordinarily radiosensitive lethality target in these primordial oocytes suggest it is the plasma membrane. Monte Carlo calculations for 0.43-MeV neutrons show that at the D_{37} only a single proton recoil will traverse the plasma membrane, consistent with the observed exponential survival curve. A highly sensitive non-DNA target for mouse oocyte killing may importantly influence interpretations of genetic mutation data from mice and their use in estimating genetic risk in humans. 7 refs., 1 fig., 1 tab.

26186 **Activities and total transformations in the GI tract for ingested radionuclides.** Maillie, H.D. (Univ. of Rochester, NY). *Health Physics;* **48**: No. 2, 224-227(Feb 1985). Contract AC02-76EV03490.

The International Commission on Radiological Protection (ICRP) has presented a model for the ingestion of radioactive isotopes. The initial differential equations are presented and the solution for the general case of a 2-comparment system is given, as well as the equations for the total number of transformations over a 50-year period in the GI compartments. Health physicists have an interest in the solution to the original differential equations, not only

for the total number of transformations but also for the time-related activities.

26187 Deposition and retention of inhaled aggregate $^{67}Ga_2O_3$ particles in beagle dogs, Fischer-344 rats, and CD-1 mice. Wolfe, R.K.; Kanapilly, G.M.; Gray, R.H.; McClellan, R.O. (Lovelace Biomedical and Environmental Research Institute, Albuquerque, NM). *American Industrial Hygiene Association Journal;* 45: No. 6, 377-381(Jun 1984). Contract AC04-76EV01013.

Deposition and retention of inhaled $^{67}Ga_2O_3$ aerosols were measured in ten beagle dogs to provide reasonable estimates for human deposition and in Fischer-344 rats and Cd-1 mice to estimate lung burdens in small animals frequently used in toxicological evaluations. Aggregated particles of $^{67}Ga_2O_3$, 0.1 μm mass median diameter (MMD), were produced using heat treatment of ^{67}Ga tetramethylheptanedione. Whole-body counting and gamma camera imaging were used to measure deposition. Pulmonary deposition in dogs was measured as 25% of the inhaled particles of the 0.1 μm particles. Tracheobronchial and nasopharyngeal deposition were much lower, 7% and 7% respectively. Pulmonary deposition of 0.1 μm (MMD) particles was calculated as 10% and 11% of inhaled particles in Fischer-344 rats and 15 and 20% in mice for two separate nose-only exposures of each species.

26188 Induction by gamma irradiation of double-strand breaks of Escherichia coli chromosomes and their role in cell lethality. Bresler, S.E.; Noskin, L.A.; Suslov, A.V. (Leningrad Institute of Nuclear Physics, USSR). *Biophysical Journal;* 45: No. 4, 749-754(Apr 1984).

Viscoelastometric measurements of DNA from γ-irradiated bacteria were used to identify the induction of double-strand breaks (DSBs) in the chromosome of Escherichia coli. It is shown by means of inhibitors of repair endonucleases and different repair mutants that most DSBs in DNA of E. coli, γ-irradiated in buffer, arise from enzymatic incision of primary γ-damages; therefore, previous conclusions regarding DSB repair must be reconsidered. Based on these results, much of the repairable damage is single-strand breaks, and this damage can initiate formation of gaps and ultimately, when repair is insufficient, generation of enzymatically caused DSBs. After extensive repair, the first residual DSB in the E. coli chromosome is generated at ~160 Gray (Gy), which corresponds to the D_{37} dose. We propose that DSBs induced directly by γ-irradiation are not repaired in wild-type strains. In a recently isolated γ-resistant strain, E. coli Gam/sup r/444, the dose required for observation of DSB after postirradiation incubation is 1000 Gy, which corresponds to the D_{37} of this strain. The resistance is proposed to be due to an ability to repair genuine DSBs.

26189 Micronuclei formation in Pisum sativum L. root meristem cells exposed to an electric field or γ-rays. Miller, M.W.; Economou, P.; Cox, C.; Robertson, D. (Univ. of Rochester, NY). *Environmental and Experimental Botany;* 22: No. 3, 271-275(1982). Contract AC02-76EV03490.

Gamma radiation (400 R, 800 R; acute exposre), but not a 430 V/m 60 Hz electric field (continuous 5 day exposure in culture medium with a conductivity of 0.08 S/m), induced micronuclei formation in root meristem cells of Pisum sativum L.

26190 Evidence of gametic mutation for flower color in Tradescantia. Emmerling-Thompson, M.; Nawrocky, M.M. (Brookhaven National Lab., Upton, NY). *Environmental and Experimental Botany;* 22: No. 4, 403-408(1982).

Data are presented that show that genetic alterations of flower color occur in the gametes of Tradescantia following gamma radiation and these alterations are transmitted through the pollen to the F_1 generation. The data demonstrate that the pink somatic mutations in petal and stamen hair cells, used as indicators of the presence of environmental mutagens, are due to hereditary changes rather than to temporary physiological alterations. The results also indicate that there exists a linear increase in gametic mutation rate of flower color as well as a linear decrease in survival to maturity as the dosage of gamma radiation increases.

5602 Thermal Effects

REFER ALSO TO CITATION(S) 26200

5603 Chemicals Metabolism And Toxicity

REFER ALSO TO CITATION(S) 25220, 25519, 25777, 25778, 26087, 26091, 26094, 26097, 26113, 26115, 26175, 26177, 26178

26191 (CONF-8303106—, pp 287-297) Heavy metals in the soil, plant and animal food-chain. Croessmann, G. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE85770201.

From 16. Essen meeting on sewage sludge - raw material or pollutant; Essen, F.R. Germany (9 Mar 1983).

Heavy metals from various sources and in different forms and concentrations reach soils and plants where they can be accumulated reversibly or irreversibly. Furthermore all soils exhibit highly varying heavy metal concentrations of geological origin. The mobilisation of heavy metal in the soil is influenced a large number of soil properties and uses. Plants too have an influence on the availability of metals. Heavy metal uptake is specified by the different types of plant and also by the various parts of a plant. An increased supply of heavy metals can lead to stresses indicated by metabolism - physiology, crop yield, phytotoxicology and residue formation. Correspondingly, the means of evaluation are very different.

26192 (DOE/ER/60142—2, pp 151-178) Factors associated with the preincubation effect of hypoxic cell sensitizers in vitro and their possible implications in chemosensitization. Towle, L.R.; Biaglow, J.E.; Varnes, M.E.; Meltzer, H.L. Jul 1984. NTIS, PC A18/MF A01. File Number DE84014885.

In Radiation physics, biophysics and radiation biology. Progress report, December 1, 1983-November 30, 1984.

The preincubation effect was studied in terms of biochemical and biological changes that could predispose cells to further damage by drugs or radiation. Dose-response data and recovery patterns for several chemosensitivity treatments on V-79-379A hamster cells are presented.

26193 (DOE/ER/60142—2, pp 179-201) Thiol depletion can selectively enhance melphalan toxicity: in vitro studies with hypoxic cell sensitizers and buthionine sulfoximine. Roizin-Towle, L.; Pirro, J. Jul 1984. NTIS, PC A18/MF A01. File Number DE84014885.

In Radiation physics, biophysics and radiation biology. Progress report, December 1, 1983-November 30, 1984.

The potential for the combined use of 2 mechanistically different types of thiol altering agents at non-cytotoxic doses of either drug using several combinations of treatments on V-79-379 A hamster cells is discussed. The importance of thiol depletions and regeneration to the vulnerability and repair capabilities of cells exposed to Melphalan was determined in the hopes of understanding the chemotherapeutic strategy necessary for utilizing this approach in vivo.

26194 (DOE/ER/60142—2, pp 305-322) Ring chromosomes and sister chromatid exchanges. Geard, C.R. Jul 1984. NTIS, PC A18/MF A01. File Number DE84014885.

In Radiation physics, biophysics and radiation biology. Progress report, December 1, 1983-November 30, 1984.

The effect of bromodeoxyuridine incorporation into the DNA of ring chromosomes on sister chromatid exchanges was studied in Vicia fabia and in Chinese hamster ovary cells. The question of switches in polarity of chromosomal DNA was also addressed.

26195 (EPRI-EA/EM—3824, pp 10.1-10.15) **Health effects and standards: physiological effects, relationship to standards.** Lebowitz, M.D. (Univ. of Arizona Health Sciences Center, Tucson). Jan 1985. Research Reports Center, Box 50490, Palo Alto, CA 94303 $23.50. File Number TI85920206. (CONF-8403172—; CONF-8405169—).

From Indoor air quality seminar - implications for electric utility conservation programs; Atlanta, GA, USA (6 Mar 1984).

Work to date on the health effects of indoor air pollutants from energy sources or that result from energy conservation measures is reviewed. The need for further work for defining acceptable standards is emphasized.

26196 **(KHM-TR—96) Respiratory disorder in the public near coal fired power plants.** Pershagen, G.; Lorich, U.; Hammar, N. (eds.). (Statens Vattenfallsverk, Vaellingby (Sweden). Projekt KOL-HAELSA-MILJOE). Apr 1983. 137p. (In Swedish). NTIS (US Sales Only), PC A07/MF A01. File Number DE85750877.

An epidemiological investigation to find out if coal fired power plants cause respiratory disorders. About 15000 people were asked to fill in questionnaires for the evaluation of symptoms and feelings of illness. 77 % answered the questions and the results indicate that the power plants in some cases may cause respiratory disorders.(K.A.E.).

26197 **(NP—5770217) Investigations on the mutagenicity of diesel engine exhaust gas components tested on salmonellae and microsomes.** Klemp, H. (Technische Hochschule Darmstadt (Germany, F.R.). Fachbereich Biologie). 15 Nov 1983. 173p. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number DE85770217.

Toxic components of exhaust gas extracts can enhance the action of mutagenous ones or head to a fictitious reduction of revertants via cell poisoning. The bacteriologically active substances contained in diesel particle emissions seem to be largely protected from the influences of temperature and light. After extraction this held true only in part. The different strains partly showed widely differing reactions in the test. The release of biologically active material was subject to considerable variations, depending on the engine operating conditions. According to these investigations some engine designs stand out by releasing a minimum of mutagenous compounds or even none at all. Recirculated exhaust gas led to higher concentrations of solid matter in the exhaust, which did not, however, spell an increase in the number of revertants. The hot cooling concept diminished the release of mutagenous matter in the low-load range. The use of cracked gas produced by thermal catalysis practically had no influence on the number of mutants. A comparative biological evaluation of different revolution numbers, engines and/or engine concepts and secondary engineering methods on the basis of exhaust density proved irrelevant. Rather, the soluble part seems to be a suitable parameter to start from in assessing limit values. The experiments with fractionated diesel particle emission extract in the concentrations tested revealed no mutagenous effect.

26198 **(NP—5770283) Pathopysiological and pathomorphological studies on the long-term effects of subtoxic vehicle exhaust concentrations in Wistar rats and SHR rats.** Fleischer, B.; Meise-Wissmann, R. (Freie Univ. Berlin (Germany, F.R.). Fachbereich Humanmedizin). 9 Aug 1982. 141p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85770283.

The effects of intermittent exposure to subtoxic CO concentrations were studied in normal and SHR rats in an experimental set-up producing a constant exhaust/air mixture with 90 ppm or 250 ppm CO. Exposure to 250 ppm CO resulted in a reduced plasma volume and a significant increase of the erythrocyte count, the haemoglobin concentration, and the haematocrit reading. The adrenal weight was significantly higher in the high-exposure rats than in the rats exposed to 90 ppm CO or the controls. Pathological changes were observed in the histological and morphometric analysis of the aortal and heart preparations of all male SHR rats. The changes were less severe in the hearts and aortas of the female SHR rats.

26199 (ORNL—6119, pp 73-104) **Mammalian genetics and reproduction section.** Russell, L.B. Jan 1985. NTIS, PC A10/MF A01. File Number DE85005663.

In Biology Division progress report, October 1, 1983-September 30, 1984.

An overview is presented of the ORNL program which is concerned with the effects of chemical and physical agents studied in the germ cells of treated mice or in offspring derived from such cells. Methods for the measurement and evaluation of such effects are developed and validated. Basic changes in the genetic material are analyzed, and sometimes exploited as tools in the study of gene structure and expression. The investigations focus on the frequency of induced heritable damage; basic genetics and cytogenetics, developmental genetics and the study of phenotypes; the interaction of chemical agents with germ-cell DNA; and reproductive biology.

26200 (ORNL—6119, pp 1-37) **Research activities: molecular and cellular genetics section.** Hartman, F.C. Jan 1985. NTIS, PC A10/MF A01. File Number DE85005663.

In Biology Division progress report, October 1, 1983-September 30, 1984.

An overview is presented of the Department of Energy's life sciences program at ORNL which has been developed for probing the multifaceted aspects of health problems associated with energy production and utilization. Interactions of radiation and chemical derived from fossil fuels with biological systems are primary concern. Membrane biology is considered of prime relevance, as membranes can be considered interfaces between the intercellular metabolic machinery and the external environment. Another aspect of cellular-environmental interactions and membrane integrity that receives emphasis is cryobiology. Other topics of concern are enzyme mechanisms and metabolic pathways. A new program in protein engineering (site-directed mutagenesis) has been initiated.

26201 (ORNL—6119, pp 39-71) **Comparative genetics section.** Preston, R.J. Jan 1985. NTIS, PC A10/MF A01. File Number DE85005663.

In Biology Division progress report, October 1, 1983-September 30, 1984.

An overview is presented of some of the approaches being taken at ORNL to provide background information for estimating adverse health effects in man from exposure to chemical agents and radiation. Several programs are investigating the possible reasons for sensitivity differences and factors that can influence sensitivity within human populations. Differences in the capacity of cells to repair DNA damage will influence the sensitivity of cells to killing and mutation induction. Studies with mammalian cells (in vivo and in vitro) and with yeast cells are directed towards understanding the mechanisms of repair of the different types of DNA lesions that can be induced by radiation and chemicals, and the cellular effects that alterations in DNA repair capacity can have.

26202 (ORNL—6119, pp 105-127) **Toxicology section.** Witschi, H.R. Jan 1985. NTIS, PC A10/MF A01. File Number DE85005663.

In Biology Division progress report, October 1, 1983-September 30, 1984.

An overview is presented of the ORNL program which is concerned with the effects of chemicals on human health. The studies focus on the pathogenesis of acute and chronic lung damage, acute and chronic skin disease, and proper functioning of the immune system. One of the most advanced programs involves the work which characterizes and explores induction and progression of the neoplastic process in the tracheal epithelium. Another development has made it possible to identify, with chemical techniques, macromolecules that have been exposed to and modified by benzopyrene. Ongoing work on RFM mice provide a well-characterized animal model for many human cancers. Numerous investigations are continuing in the field of experimental pulmonary toxicology.

26203 **(UCRL—92329) Use of environmental health-risk analysis for managing toxic substances.** McKone, T.E. (Lawrence Livermore National Lab., CA (USA)). Mar 1985. Contract W-7405-ENG-48. 17p. (CONF-850612—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85008964.

From Air Pollution Control Association annual meeting and exhibition; Detroit, MI, USA (16 Jun 1985).

This paper presents a set of simple models used to assess health risks based on toxicity, environmental mobility and persistence. These models use a representative landscape in order to describe the steady-state distribution of arsenic, tritiated water, and TCDD as a result of continuous additions to soil. This information is used to assess potential exposures. Application of the screening model to three chemically different carcinogens reveals that the environmental health risk does not scale with direct measures of toxicity. As estimated here, the environmental health risk of TCDD relative to tritiated water and arsenic is roughly an order of magnitude less than its cancer potency relative to these compounds. The difference is attributable in large part to the immobility of TCDD relative to tritium and the lower persistence of TCDD compared to arsenic. The purpose is to present a simple procedure for using the relative behavior of toxic species under prototype conditions as a basis for risk management. 21 refs., 4 tabs. (ACR)

26204 **Effects of temperature, feeding and acridine on reproduction of the calanoid copepod, Diaptomus clavipes Schacht.** Cooney, J.D.; Gehrs, C.W. (Oak Ridge National Lab., TN). *Environmental Pollution, Series B: Chemical and Physical;* **37**: No. 1, 53-70(1985). Contract W-7405-ENG-26.

Chronic toxicity determinations (using changes in reproduction as an index of toxicant stress) were performed on adults of the freshwater calanoid copepod, Diaptomus clavipes, at temperatures of 16, 21 and 26°C. Adults were paired and then exposed for 15 days to five concentrations (0.32-3.2 mg liter^{-1}) of the azaarene, acridine, in a renewal system. Two control groups (methanol control and well water control) were also used. Four reproductive criteria (number of eggs per clutch, number of clutches per female per day, number of eggs per female per day and percentage egg hatch) were evaluated. Mean clutch size was significantly reduced in acridine-exposed animals only at 21°C. Rate of clutch production was a more sensitive indicator of acridine stress than clutch size at all temperatures tested. Rate of egg production yielded results similar to those for clutch size. Egg viability was not affected by either temperature or acridine concentration, with more than 84% of the eggs hatching in most cases. No reproduction occurred at the highest acridine concentration tested (3.2 mg liter^{-1}) at all three temperatures; copepods at the next highest acridine concentration (1.8 mg liter^{-1}) produced only 2.5% of the total 1127 clutches produced in all exposure conditions.

26205 **Nutrient limitation of phytoplankton growth in Georgia nearshore waters.** Bishop, S.S.; Emmanuele, K.A.; Yoder, J.A. (Skidaway Institute of Oceanography, Savannah, GA). *Estuaries;* **7**: No. 4B, 506-512(Dec 1984). Contract AS09-76EV00936.

Nutrient enrichment experiments were conducted to investigate the utilization of dissolved organic (DON) and inorganic nitrogen (DIN) by marine phytoplankton in Georgia coastal waters. Natural populations of marine phytoplankton, enriched with different concentrations of ammonium chloride and other plant nutrients, were grown under controlled temperature and irradiance conditions until the populations reached "stationary phase." Results showed that (1) phytoplankton are limited by DIN up to ca. 20 μM, when another nutrient (phosphate or silicate) becomes limiting, (2) very little naturally-occuring DON is directly utilized for growth, (3) very little DON is indirectly made available for growth over time periods of days to ca. 1 week, and (4) trace metals and vitamins do not significantly limit phytoplankton growth.

26206 **Effects of acridine and temperature on the survival, development, growth, and reproduction of Diaptomus clavipes Schact.** Cooney, J.D.; Bunting, D.L. II; Gehrs, C.W. (Battelle-Columbus Laboratories, OH). *Archives of Environmental Contamination and Toxicology;* **13**: No. 6, 665-674(Nov 1984). Contract AC05-84OR21400.

The effects of the azaarene acridine (a component of synthetic fuels) on survival, growth, development, and reproduction of the freshwater calanoid copepod, Diaptomus clavipes, were measured at 16, 21 and 26°C. Males and females from stock cultures were paired and exposed to five concentrations of acridine (0.32-3.2 mg/L). Observations on hatching, molting, and mortality were made hourly for the egg stage, at 8-hr intervals from the first naupliar stage to the first copepodid stage, and at 12-hr intervals from the first copepodid stage to the adult stage. Chronic toxicity determinations (using changes in reproduction as an index of toxicant stress were performed on these adults. No stock females produced viable egg clutches at acridine concentrations above 1.0 mg/L except at 26°C, where egg clutches were produced at 1.8 mg/L acridine. The reproductive estimates most sensitive to acridine stress were the rates of egg and clutch production. Clutch size and time to first egg clutch were adversely affected only at 1.0 mg/L. Percent egg hatch exceeded 90% for all treatment combinations. The interaction between temperature and acridine had its most pronounced effect on life stage duration (first naupliar stage to the adult stage) with more than a threefold increase in sensitivity to acridine from 16 to 21°C.

26207 **Laryngeal cancer and occupational exposure to sulfuric acid.** Soskolne, C.L.; Zeighami, E.A.; Hanis, N.M.; Kupper, L.L.; Herrmann, N.; Amsel, J.; Mausner, J.S.; Stellman, J.M. (Univ. of Toronto, Ontario). *American Journal of Epidemiology;* **120**: No. 3, 358-369(Sep 1984). (CONF-8306266—).

From 16. annual meeting of the Society for Epidemiologic Research; Winnipeg, Manitoba, Canada (15 Jun 1983).

Workers on an ethanol unit which used sulfuric acid in strong concentrations at a large refinery and chemical plant in Baton Rouge, Louisiana were reported in 1979, at excess risk for upper respiratory cancer. The carcinogen implicated by indirect evidence was diethyl sulfate. However, with the continued use of sulfuric acid in the same plant, and with additional cases not attributable to the ethanol process, the hypothesis of an association between sulfuric acid exposure and upper respiratory cancer was tested. Each of 50 confirmed cases of upper respiratory cancer diagnosed between 1944 and 1980, was matched to at least three controls on sex, race, age, date of initial employment, and duration of employment. Thrity-four of the 50 cases were laryngeal cancers. Data were obtained from existing plant records. Retrospective estimates of exposure were made without regard to case or control status. Findings from conditional logistic regression techniques were supported by other statistical methods. Among workers classified as potentially highly exposed, four-fold relative risks for all upper respiratory cancer sites combined were exceeded by the relative risk for laryngeal cancer specifically. Exposure-response and consistency across various comparisons after controlling statistically for tobacco-use, alcoholism and other previously implicated risk factors, suggest increased cancer risk with higher exposure.

26208 **Base-pairing properties of O^6-methylguanine in template DNA during in vitro DNA replication.** Snow, E.T.; Foote, R.S.; Mitra, S. (Oak Ridge National Lab., TN). *Journal of Biological Chemistry;* **259**: No. 13, 8095-8100(10 Jul 1984). Contract W-7405-ENG-26.

The kinetics of incorporation of deoxynucleotide precursors directed by the promutagenic base, O^6-methylguanine (m^{6}Gua), was analyzed in vitro replication of m^{6}Gua-containing synthetic polydeoxynucleotides by T4 and T5 phage DNA polymerases and Escherichia coli DNA polymerase I. When poly(dT,m^{6}dG) and poly(dC,m^{6}dG) with covalently attached primers were replicated, O^6-methylguanine paired with either thymine or cytosine but with a much higher preference for thymine, dCTP, and dTTP acted as competitive inhibitors of each other during DNA synthesis. O^6-methylguanine also directed incorporation of dAMP by T5 DNA polymerase. This dAMP incorporation was not inhibited by dTTP. Contrary to theoretical predictions that the m^{6}dG.dT pair should be comparable to the dA.dT pair, the presence of m^{6}dG in the template inhibited DNA synthesis. Based on K/sub mm//sup app/ values, E. coli DNA polymerase I showed a much higher preference for dTMP incorporation over dCMP opposite m^{6}dG in the template than T4 and T5 DNA polymerases. At the same time, there was a higher turnover of dCTP than of dTTP by the E. coli enzyme. However, in all cases, the turnover of deoxynucleotides during replication of m^{6}Gua-containing templates was more than that observed with templates without the alkylated base.

26209 Recent progress in nickel carcinogenesis. Sunderman, F.W. Jr. (Univ. of Connecticut School of Medicine, Farmington). *Toxicological and Environmental Chemistry Reviews;* **8**: No. 4, 235-252(1984). (CONF-8309223—).

From 1. international workshop on carcinogenic and/or mutagenic metals; Geneva, Switzerland (11 Sep 1983).

Research on nickel carcinogenesis from 1979 to 1983 is reviewed. Epidemiological studies have strengthened the evidence that workers in nickel refineries have increased risks of lung and sinonasal cancers, but have not substantiated increased risks of respiratory cancers in other nickel-exposed workers. Carcinogenesis bioassays have demonstrated carcinogenicity of certain nickel sulfide, hydroxide, selenide, arsenide, antimonide, and telluride compounds following parenteral administration to rodents. Positive bacterial mutagenesis tests have been obtained with Ni[II] in Corynybacterium, but not in E. coli, S. typhimurium, or B. subtilis. Transformation assays of several soluble and crystalline Ni compounds have been positive in Syrian hamster embryo cells. Ni[II] binds to DNA, RNA, and nucleoproteins, and becomes localized in nucleoli. Genotoxic effects of Ni include: (a) chromosomal aberrations, including sister-chromatid exchanges, (b) DNA strandbreaks and DNA-protein cross-links, (c) inhibition of DNA and RNA synthesis, (d) infidelity of DNA transcription, and (e) mutations at the HGPRTase locus in Chinese hamster cells and the TK locus in mouse lymphoma cells. These findings are consistent with somatic mutation as the mechanism for initiation of nickel carcinogenesis. Ni compounds cause reversible transition of double-stranded poly(dG-dC) DNA from the right-handed B-helix to the left-handed Z-helix, suggesting a mechanism whereby nickel might modulate oncogene expression. 99 references, 6 tables.

26210 Glucocorticoid receptor levels in mouse skin after repetitive applications of 12-O-tetradecanoylphorbol-13-acetate. Davidson, K.A.; Slaga, T.J. (Oak Ridge National Lab., TN). *Cancer Research;* **43**: 3847-3851(Aug 1983). Contract W-7405-ENG-26.

Female Sencar mice were given twice weekly topical applications of 0.2 ml of acetone, 4 μg of 12-O-tetradecanoylphorbol-13-acetate (TPA), 2 μg of mezerein, or 4 μg of TPA followed by 2 μg of mezerein. Whole skin cytoplasmic glucocorticoid receptor content and dissociation constants were determined at various times after the last application of agents. After four to 12 applications of acetone, the mean glucocorticoid receptor level was 0.49 +/- 0.02 pmol/mg cytosol protein, and the dissociation constant was 6.0 +/- 0.17 nm. The glucocorticoid receptor level was markedly reduced and remained low for at least 72 hr after repetitive applications of TPA. The mean receptor level was 0.113 +/- 0.011 (SE) pmol/mg cytosol protein, and the K/sub d/ was 2 to 4 times the control value. In contrast, the glucocorticoid receptor level was not significantly reduced after repetitive applications of mezerein. If four applications of mezerein were preceded by four applications of TPA, then the glucocorticoid receptor level was similar to that after TPA alone. It was also demonstrated that the glucocorticoid receptor level in papillomas was extremely low (0.022 pmol/mg cytosol protein) but was much higher in newborn skin (0.52 pmol/mg cytosol protein).

26211 Investigation of correlations between chemical parameters of metal ions and acute toxicity in mice and Drosophila. Turner, J.E.; Lee, E.H.; Jacobson, K.B.; Christie, N.T.; Williams, M.W.; Hoeschele, J.D. (Oak Ridge National Lab., TN). *Science of the Total Environment;* **28**: 343-354(1983). Contract W-7405-ENG-26.

The correlations between physicochemical properties associated with metal ions and observed toxicity are being studied. In order to test correlations, we obtained, under uniform conditions, LD50 values for acute toxicity in mice for 24 metal ions. The new data show a better correlation between LD50 and Pearson and Mawby's softness parameter σ/sub p/, defined using chemical concepts of hard and soft acids and bases, than had been obtained by others. From a wide range of physicochemical parameters, the electrode potential can give almost as good a correlation as σ/sub p/. Better correlations might exist for parameters more relevant to biological systems. 22 references, 1 figure, 4 tables.

26212 Quantitative aspects of metal ion content and toxicity in Drosophila. Christie, N.T.; Gosslee, D.G.; Bate, L.C.; Jacobson, K.B. (Univ. of Tennessee-Oak Ridge Graduate School of Biomedical Sciences). *Toxicology;* **26**: 295-312(1983). Contract W-7405-ENG-26.

As a basis for both a genetic and a biochemical approach to a study of metal ion effects, a method for quantitating the toxic response of Drosophila to metal ions was developed. The response to 13 metal ions has been examined, including Zn^{2+}, Cd^{2+}, and Hg^{2+}, Be^{2+}, Mg^{2+}, Sr^{2+}, and Ba^{2+}, Ni^{2+}, Cu^{2+}, Co^{2+}, Mn^{2+}, Y^{3+} and Cr^{3+}. Although there was a general trend of increasing values of range with increasing LC_{50} values, the exceptions (e.g., Cr^{3+} and Be^{2+}) indicated that several factors may be involved in determining the range of lethal responses. Elemental analyses have been performed on flies before and after metal ion treatments to establish the amount of metal ion taken up and baselines for comparison. This study provides additional evidence that Drosophila is an appropriate organism for the study of specific biochemical alterations induced by metals, e.g., the cadmium-induced increase in Q(+)tRNAs. 33 references, 5 figures, 5 tables.

26213 Effect of lung, liver, and kidney toxicants on respiratory rate in the mouse. Hakkinen, P.J.; Frankel, R.; Morse, C.C.; Witschi, H. (Univ. of Tennessee-Oak Ridge Graduate School of Biomedical Sciences). *Toxicology;* **26**: 181-192(1983). Contract W-7405-ENG-26.

The intraperitoneal administration of either butylated hydroxytoluene (BHT) +/- thoracic X-irradiation, or cyclophosphamide, and intravenous injection of oleic acid, resulted in lung injury and repair in BALB/c mice which could be assessed in unanesthetized animals by changes in respiratory rate (RR). Studies with BHT +/- X-rays, and cyclophosphamide found that the RR right before sacrifice (2 weeks after BHT and 3 weeks after cyclophosphamide) correlated well ($r = 0.19$) with the degree of pulmonary fibrosis as measured by changes in hydroxyproline content. However, prior to this timepoint, there was a peak and trough in respiratory rate response that could not be correlated with the time course of fibrosis development in the BHT-X-ray model. In an effort to determine the influence of pulmonary edema and lung cell proliferation on respiratory rate changes, an agent (oleic acid) capable of producing lung injury followed by a high level of cellular proliferation with only minimal development of fibrosis was studied. These studies showed that good correlations were found on day 3 following injection (day of peak increase in respiratory rate) between respiratory rate and either lung wet weight ($r = 0.81$) or the degree of cellular proliferation as measured by the incorporation of thymidine into pulmonary DNA ($r = 0.80$). Liver (carbon tetrachloride) and kidney (mercuric chloride) toxicants, and starvation produced decreases or no change in RR. 24 references, 6 figures.

26214 Ornithine decarboxylase induction by chemically complex liquids from two solvent refined coal processes. Swanger, D.; Mahlum, D.D.; Springer, D.L. (Eastern Oregon State College LaGrande). *Carcinogenesis (New York);* **4**: No. 7, 805-810(1983). Contract AM06-70RL02225;AC06-76RL01830.

Studies with a variety of chemical purified substances have suggested that induction of the enzyme ornithine decarboxylase (ODC) in mouse epidermal cells may be a reliable indicator of neoplastic transformation. In an effort to extend these observations on ODC to chemically complex materials, we examined ODC induction by carcinogenic and non-carcinogenic mixtures and compared these results with tumorigenicity data for these materials. Several boiling range fractions and several solvent-derived subfractions from two solvent-refined coal processes (SRC-I and SRC-II) were evaluated for their ability to induce ODC. Single applications of heavy distillate (HD), the SRC-II high-boiling fraction and a potent mouse skin carcinogen, produced ODC induction kinetics which were similar to that for 12-O-tetradecanoylphorbol-13-acetate (TPA). Both HD and TPA stimulated maximal ODC activity 3-5 h after application, with epidermal ODC levels returning to basal levels within 12 h. The magnitude of ODC induction after multiple applications of HD was not as great as that observed for TPA. Single skin applications of TPA and HD also transiently elevated hepatic ODC levels. Liver ODC activity did not increase following

multiple applications of either. ODC induction by HD was also dose-dependent. Relative to controls, single applications of HD and process solvent elevated ODC levels. Light distillate and light oil increased ODC levels, and middle distillate and wash solvent stimulated < 2- to 8-fold increases in ODC. Single applications of three solvent-derived subfractions of HD, which are complete carcinogens, induced 3- to 7-fold ODC elevations over background levels; multiple applications of subfractions elevated ODC levels. Of the complex mixtures evaluated during this study, all complete carcinogens induced ODC; however, the magnitude and temporal pattern of induction varied with the material tested.

26215 cdc9 Ligase-defective mutants of Saccharomyces cerevisiae exhibit lowered resistance to lethal effects of bleomycin. Moore, C.W. (Univ. of Rochester, NY). *Journal of Bacteriology;* **151**: No. 3, 1617-1620(Sep 1982). Contract AC02-76EV03490.

Conditional ligase-deficient mutants of Saccharomyces cerevisiae were more sensitive than their parental (CDC9) strain to dose-dependent killing by bleomycin, even when mutant cells were pregrown and exposed to the antibiotic at permissive temperatures. Pretreatment incubation at the restrictive temperature (37°C) under growing or nongrowing conditions enhanced bleomycin killing of both cdc9-1 and cdc9-9 mutants. This sensitization could be relieved by incubation at the permissive temperature before treatment.

26216 Mutagenicity of diesel exhaust particle extracts: influence of non-petroleum fuel extenders. Clark, C.R.; McClellan, R.O.; Marshall, W.F.; Naman, T.M.; Seizinger, D.E. (Inhalation Toxicology Research Institute, Albuquerque, NM). *Archives of Environmental Contamination and Toxicology;* **11**: 749-752(1982). Contract AC04-76EV01013.

The mutagenicity of dichloromethane extracts of diesel particulate exhaust, collected while the engine was running at steady state on diesel fuel alone was higher than when 10% ethanol, butanol, and a middle distillate fraction of SRC-II (a solvent refined coal liquid) were added to the fuel (Salmonella strains TA-98 and TA-100). Although the three fuel extenders decreased the specific mutagenicity of the extracts, they increased the amount of particle-associated organic material 2 to 4-fold, resulting in higher estimates of mutagenicity emitted from the exhaust than that calculated for diesel fuel alone. Small increases in total hydrocarbons and carbon monoxide emissions were measured when butanol and SRC-II were added. Particulate emissions were 15% lower for the three fuel extenders compared to diesel fuel alone.

26217 Assessment of the impact on crops of effluent gases from geothermal energy development in the Imperial Valley, California. Kercher, J.R. *Journal of Environmental Management;* 1-26(22 May 1981). Contract W-7405-ENG-48.

We have assessed the potential impact of regionally dispersed sources of geothermal gaseous effluents on crops in the Imperial Valley. We used a detailed model of the photosynthesis and growth of sugar beets fumigated by H_2S and CO_2 and generalized from the model calculations to other crops. Model calculations were made with estimates of time series of expected ground-level concentrations of H_2S and CO_2 calculated by the Air Quality Assessment element of the Imperial Valley Environmental Project (IVEP) at 22 locations around the valley. Results indicate that in the absence of interactions with other ambient pollutant gases, all locations would experience an increase (from slight to significant) in total growth of sugar beets. Seven locations will experience an increase of at least 10%. We calculated the emissions rate at which negative effects cancel out the benefits of H_2S fertilization; in the worst case, emission rates are expected to be no more than 1/13 this crossover rate. The expected emission rate will be less than that necessary for negative effects on the most sensitive species (such as alfalfa) by a factor of 4. Similar results for other crops are summarized in the report. If CO_2 emissions are increased proportionately, the dominance of deleterious effects is not expected to occur even under maximum development as set forth in IVEP scenario projections. 23 references, 8 figures, 6 tables.

5604 Other Environmental Pollutant Effects

REFER ALSO TO CITATION(S) 26189

26218 (DOE/OR/06021—2) Damaging effects of visible light. Progress report. Williams, T.P. (Florida State Univ., Tallahassee (USA)). 1980. Contract AS05-78OR06021. 51p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85010151.

Research progress in studies of photodynamic damage of visual photoreceptors is presented. It was found the retina is not homogeneous in its susceptibility to light damage. Steady state rhodopsin levels have been evaluated in albino rats and in pigmented rats at several light intensities. Studies have continued of the effects of peroxidative photodynamic damage on the properties of rod outer segments. (ACR)

57 HEALTH AND SAFETY

26219 (DOE/SR/10995—1) Human factors considerations in the development and use of emergency management plans. Becker, J.A.; Greenstein, J.S. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Human Factors Lab.). Jul 1984. Contract AC09-82SR10995. 44p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85009867.

Human capabilities for emergency management are many; they include assessing the situation, drawing inferences, and taking appropriate action. Limitations include degradation of performance when working under extreme stress; and the possibility of making incorrect decisions. Plans must be designed so that human capabilities are emphasized, and the potential consequences of human limitations are minimized. This paper discusses the human factors affecting four aspects of emergency management plans: hardcopy presentation of plans, flowcharts, graphics, and softcopy presentation of plans. 25 refs., 6 figs.

58 GEOSCIENCES

5801 Geology And Hydrology

REFER ALSO TO CITATION(S) 25182, 25254, 25300, 25317, 26234

26220 (DOE/NV/10322—1) Lithologic and geophysical logs of selected drill holes in Areas 1, 3, and 6, Nevada Test Site. Volume I. Drellack, S.L. Jr.; Gonzales, J.L.; Davies, W.J. (Fenix and Scisson, Inc., Mercury, NV (USA)). Jun 1982. Contract AC08-84NV10322. 91p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85010690.

This report is a compilation of drill hole data from holes completed between July 1979 and May 1982 in Areas 1, 3, and northern Area 6, Nevada Test Site. Data presented in this report includes hole locations, stratigraphy and lithology penetrated, selected geophysical logs, and drilling statistics. Description and stratigraphic identification of the Tertiary volcanic rocks is emphasized. 14 figs., 2 tabs.

26221 (DOE/NV/10322—2) Lithologic and geophysical logs of selected drill holes in eastern Area 7, Nevada Test Site. Volume II. Gonzales, J.L.; Drellack, S.L. Jr.; Davies, W.J. (Fenix and Scisson, Inc., Mercury, NV (USA)). Aug 1982. Contract AC08-84NV10322. 138p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE85010691.

This report is a compilation of drill hole data from holes completed between December 1979 and June 1982 (this includes a 1972 drill hole described geologically in May 1981) in eastern Area 7, Nevada Test Site. Data presented in this report includes hole locations, stratigraphy and lithology penetrated, selected geophysical logs, and drilling statistics. Description and stratigraphic identification of the Tertiary volcanic rocks is emphasized. 14 figs., 2 tabs.

26222 (DOE/NV/10322—3) Lithologic and geophysical logs of selected drill holes in eastern Area 4, and western Area 7, Nevada Test Site. Volume III. Davies, W.J.; Gonzales, J.L.; Drellack, S.L. Jr. (Fenix and Scisson, Inc., Mercury, NV (USA)). Dec 1982. Contract AC08-84NV10322. 155p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85010693.

This report is a compilation of drill hole data from holes completed between November 1979 and August 1982 in eastern Area 4 and western Area 7, Nevada Test Site. Data presented in this report includes hole locations, stratigraphy and lithology penetrated, selected geophysical logs, and drilling statistics. Description and stratigraphic identification of the Tertiary volcanic rocks is emphasized. 16 figs., 2 tabs.

26223 (DOE/NV/10322—4) Lithology and stratigraphy of selected drill holes in Areas 3 and 7, and the eastern parts of Areas 1 and 4, Nevada Test Site. Volume IV. Drellack, S.L. Jr.; Davies, W.J.; Gonzales, J.L. (Fenix and Scisson, Inc., Mercury, NV (USA)). Mar 1983. Contract AC08-84NV10322. 180p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE85010694.

This report catalogs all drill holes completed between August, 1975 and February, 1980 in Areas 3 and 7, and the eastern parts of Areas 1 and 4, Nevada Test Site. Data presented in this report includes hole locations, stratigraphy, and lithology. Description and stratigraphic identification of the Tertiary volcanic rocks is emphasized. 4 figs., 4 tabs.

26224 (DOE/NV/10322—5) Lithology and stratigraphy of selected drill holes in LANL use areas of Yucca Flat, Nevada Test Site. Volume V. Drellack, S.L. Jr.; Gonzales, J.L.; Davies, W.J. (Fenix and Scisson, Inc., Mercury, NV (USA)). Jun 1984. Contract AC08-84NV10322. 154p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85010692.

This report is a compilation of data from drill holes completed, except where noted, during the calendar year 1983 in areas used by Los Alamos National Laboratory in Yucca Flat, Nevada Test Site. Data presented in this report includes hole locations, drilling statistics, a supplemental data sheet, stratigraphy and lithology penetrated, and selected geophysical logs including a log of drilling penetration rate. Lithologic description and stratigraphic identification of the Tertiary volcanic rocks are emphasized. 19 figs., 2 tabs.

26225 (DOE/NV/10322—6) Lithology and stratigraphy of drill holes completed during 1984 in LANL use areas of Yucca Flat, Nevada Test Site. Volume VI. Gonzales, J.L.; Drellack, S.L. Jr.; Davies, W.J. (Fenix and Scisson, Inc., Mercury, NV (USA)). Jan 1985. Contract AC08-84NV10322. 154p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85010695.

This report is a compilation of data from drill holes completed during the calendar year 1984 in areas used by Los Alamos National Laboratory in Yucca Flat, Nevada Test Site. Data presented in this report includes hole locations, drilling statistics, a supplemental data sheet, stratigraphy and lithology penetrated, and selected geophysical logs including a log of drilling penetration rate. Lithologic description and stratigraphic identification of the Tertiary volcanic rocks are emphasized. 20 figs., 2 tabs.

26226 (LBL—18552) Numerical studies of fluid and heat flow near high-level nuclear waste packages emplaced in partially saturated fractured tuff. Pruess, K.; Tsang, Y.W.; Wang, J.S.Y. (Lawrence Berkeley Lab., CA (USA)). Nov 1984. Contract AC03-76SF00098. 51p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85010639.

We have performed modeling studies on the simultaneous transport of heat, liquid water, vapor, and air in partially saturated fractured porous rock. Formation parameters were chosen as representative of the potential repository horizon in the Topopah Spring Unit of the Yucca Mountain tuffs. The presence of fractures makes the transport problem very complex, both in terms of flow geometry and physics. The numerical simulator "TOUGH" used for our flow calculations takes into account most of the physical effects which are important in multi-phase fluid and heat flow. It has provisions for handling the extreme non-linearities which arise in phase transitions, component disappearances, and capillary discontinuities at fracture faces. We model a region around an infinite linear string of nuclear waste canisters, taking into account both the discrete fractures and the porous matrix. From an analysis of the results obtained with explicit fractures, we develop equivalent continuum models which can reproduce the temperature, saturation, and pressure variation, and gas and liquid flow rates of the discrete fracture-porous matrix calculations. The equivalent continuum approach makes use of a generalized relative permeability concept to take into account the fracture effects. This results in a substantial simplification of the flow problem which makes larger scale modeling of complicated unsaturated fractured porous systems feasible. Potential applications for regional scale simulations and limitations of the continuum approach are discussed. 35 refs., 14 figs., 4 tabs.

26227 (RHO-BW-SA—366P) Stochastic groundwater traveltime modeling using a Monte Carlo technique. Clifton, P.M.; Sagar, B.; Baca, R.G. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). Mar 1984. Contract AC06-77RL01030. 23p. (CONF-850101—10; CONF-850170—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85009752.

From International congress on hydrology of rocks of low permeability; Tucson, AZ, USA (7 Jan 1985).

A method of stochastically modeling groundwater traveltimes is described. This method is based on a Monte Carlo technique, which is used to generate a suite of random spatial fields. These fields are subsequently input to the groundwater flow and groundwater traveltime equations. Uncertain inputs to these equations can be: (1) transmissivity (or hydraulic conductivity); (2) effective thickness (or effective porosity); and (3) boundary conditions. In a transient problem, the storage coefficient (or specific storage) could also be stochastically treated. Spatial correlation in the random input fields is accounted for by means of a multivariate normal random-number generator, which requires that the first two statistical moments of these fields be specified. The output from the Monte Carlo analysis is a suite of random groundwater traveltime realizations that can be subsequently used to derive exceedance probabilities. These probabilities provide a means of assessing the degree of confidence in the groundwater traveltime predictions. An example of how to apply this method using available preliminary field data from the deep basalts beneath the US Department of Energy's Hanford Site in south-central Washington State is presented. The results from this type of analysis will ultimately be utilized in assessing the confidence in complying with a technical criterion relating to groundwater traveltime. Sensitivity analyses illustrate how these results change when some of the stochastic inputs are varied, and provide an emprical measure of how to optimally apply the method. This type of analysis will be updated as more field data become available. 22 refs., 5 figs.

26228 (RHO-BW-SA—372P) Chlorine isotopes as environmental tracers in Columbia River basalt groundwaters. Graham, D.L.; Gifford S.; Bentley, H. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations; Hydro Geo Chem., Inc., Tucson, AZ (USA)). Mar 1984. Contract AC06-77RL01030. 21p. (CONF-850170—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85011392.

From 17. International Association of Hydrologists international congress; Tucson, AZ, USA (7 Jan 1985).

Chlorine-36 analyses were performed on 21 groundwater samples collected from six boreholes penetrating the Saddle Mountains, Wanapum, and Grande Ronde Formations of the Columbia River basalts. These samples were collected from depths of 136 to 1353 m below land surface and represent waters from both sedimentary interbeds and basalt flow top aquifers. Measured levels of ^{36}Cl (atoms/L x 10^{-7}) ranged from 3 to 26 and $^{36}Cl/Cl$ ratios ranged from 7 to 1130 (x 10^{15}). The highest ^{36}Cl ratios were interpreted as modern input of ^{36}Cl and are two to three times that predicted for this latitude. Analyses of stable chlorine isotopes were performed on 14 samples form 7 boreholes penetrating the Wanapum and Grande Ronde Formations. Ratios of $^{37}Cl/^{35}Cl$ range from +0.46% (accuracy to two decimal points) relative to Standard Mean Ocean Chloride (SMOC). Negative $\delta^{37}Cl$ values were associated with the lowest groundwater chloride concentrations.

Chlorine isotopic information was used to arrive at a groundwater flow model suggesting that recharge is occurring in the western portion of the Hanford Site with shallow circulation through the Saddle Mountains and Wanapum Basalts, and upward flow from the Grande Ronde Basalts to the Wanapum Basalts to the east of the Reference Repository location. In addition to meteoric chloride, a second chloride source was hypothesized. Two explanations are proposed which account for this source of chloride: (1) chloride previously dissolved and transported into the basalt groundwaters from an external source and/or (2) chloride leached from the host rock. The low ^{36}Cl concentration associated with this second source of chloride implies a very long residence time. One sample from the deep Grande Ronde indicates a groundwater age in excess of 300,000 yr. 11 refs., 7 figs., 2 tabs.

26229 (USGS/WRI—84-4345) Conceptual hydrologic model of flow in the unsaturated zone, Yucca Mountain, Nevada. Montazer, P.; Wilson, W.E. (Geological Survey, Lakewood, CO (USA)). 1984. Contract AI08-78ET44802. 59p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85008346.

The purpose of this report is to propose a conceptual hydrologic model that reasonably describes the flow of fluids through the unsaturated zone at Yucca Mountain, for use as a basis for preliminary site-performance assessment and as a guide to further investigations. Scott and others (1983) presented an initial conceptual hydrogeologic model for the unsaturated zone at Yucca Mountain, based on detailed geologic, but very limited hydrologic, information. In this report, some of their concepts are examined and either supported or modified, and new concepts are developed. The model describes the manner in which flow probably occurs at Yucca Mountain and is based on: (1) current understanding of the hydrogeologic framework; (2) application of the principles of unsaturated flow; and (3) interpretation of some preliminary data from ongoing field and laboratory investigations. Included are extensive geologic information but relatively few hydrologic data that currently exist from the unsaturated zone in the Yucca Mountain area. Many uncertainties remain to be resolved concerning hydrologic conditions and processes. As a result, most of the concepts presented are intentionally descriptive and conjectural, with little quantitative basis provided. However, for the sake of directness and simplicity of expression, the model is presented as if it were a true expression of the facts. The authors recognize, and the reader should be aware, that the proposed model probably is not the only reasonable description that could be made at this point, and it certainly is subject to revision and quantification as more data become available. Although various alternative models probably could be developed, the one described in this report seems to fit current understanding of the unsaturated flow through a section of layered, fractured-rock formations with contrasting hydrologic properties, such as occurs at Yucca Mountain. 41 refs., 14 figs., 1 tab.

26230 Late quaternary plant zonation and climate in southeastern Utah. Betancourt, J.L. (Univ. of Arizona, Tucson). *Great Basin Naturalist;* **44**: No. 1, 1-35(31 Jan 1984).

Plant macrofossils from packrat middens in two southeastern Utah caves outline development of modern plant zonation from the late Wisconsin. Allen Canyon Cave (2195 m) and Fishmouth Cave (1585 m) are located along a continuous gradient of outcropping Navajo Sandstone that extends from the Abajo Mountains south to the San Juan River. By holding the site constant, changes in the floral composition for a plot of less than one hectare can be observed, even if sporadically, over tens of millennia. At Allen Canyon Cave, Engelmann spruce-alpine fir forest was replaced by the present vegetation consisting of pinyon-juniper woodland on exposed ridgetops and cliffside stands of Douglas fir, ponderosa pine, and aspen. Xerophytic woodland plants such as pinyon, plains prickly pear, and narrowleaf yucca arrived sometime in the middle Holocene between 7200 and 3400 B.P. At Fishmouth Cave, Utah juniper in Holocene middens replaced blue spruce, limber pine, Douglas fir, and dwarf and Rocky Mountain junipers in late Wisconsin samples. Quantitative climatic estimates are derived for the late Wisconsin by applying vertical gradients for temperature and precipitation to the amount of vegetation depression. The Fishmouth Cave sequence indicates a minimum lowering of 850 m for blue spruce, limber pine, and dwarf juniper. A depression of at least 700 m for Engelmann spruce and alpine fir is suggested for the Allen Canyon locality. Use of conservatively low gradients for stations below 2080 m yields a 3-4 C cooling from present mean annual temperature and 35 to 60% more rainfall than today. Steeper gradients associated with more mountainous terrain suggest a 5 C lowering in temperature and up to 120% increase over modern precipitation. 81 references, 6 figures, 10 tables.

5802 Geophysics

REFER ALSO TO CITATION(S) 25248, 25249, 25315, 25316, 25488, 25489, 25830, 26045, 26047, 26050, 26051, 26052

26231 (AD-A—150788/8/XAB) Study of terrain reductions, density anomalies and geophysical inversion methods in gravity-field modeling. Technical report. Forsberg, R. (Ohio State Univ. Research Foundation, Columbus (USA)). Apr 1984. 134p. NTIS, PC A07/MF A01.

The general principles of the use of known density anomalies for gravity-field modeling are reviewed with special emphasis on local applications and utilization of high-degree and -order spherical-harmonic reference fields. The natural extension to include also unknown density anomalies are studied within the framework of geophysical-inversion methods, and the prospects for hybrid gravity-field modeling/inversion methods are outlined. A very simple case of such methods is the determination of representative topographic densities through collocation with parameters.

26232 (LBL—19180) Effects of contact area of an interface on acoustic wave transmission characteristics. Myer, L.R.; Hopkins, D.; Cook, N.G.W. (Lawrence Berkeley Lab., CA (USA)). Mar 1985. Contract AC03-76SF00098. 12p. (CONF-850671—16). NTIS, PC A02/MF A01; GPO Dep. File Number DE85009935.

From 26. U.S. symposium on rock mechanics; Rapid City, SD, USA (26 Jun 1985).

This paper discusses a new model in which attenuation as well as group velocity changes are explained by a single set of assumptions. The basis of this model is that a joint or fracture represents a displacement discontinuity across which average stresses in seismic waves are continuous but displacements are not. The model is linear elastic so that all material properties are real valued. It is applicable to cases in which the fractures are large in extent but small in thickness compared to the wavelength of the seismic waves. Laboratory experiments were performed in which a single fracture was represented by an interface between two steel cylinders. Measured attenuation of compressional (P) and polarized shear (S) waves was compared with model predictions.

26233 (USGS-OFR—83-744) Review of earthquake activity and current status of seismic monitoring in the region of the Bradley Lake Hydroelectric Project, southern Kenai Peninsula, Alaska, December 1981-May 1983. Stephens, C.D.; Lahr, J.C.; Page, R.A.; Rogers, J.A. (Geological Survey, Menlo Park, CA (USA)). 1983. 25p. US Geological Survey Open File Services, Box 25425, Denver Federal Center, Denver, CO 80225. File Number TI85901340.

A project investigating seismic hazards in the Bradley Lake area of Kenai Peninsula is summarized. Hypocenters of 91 shallow (depth less than 20 km) earthquakes that occurred between December 1981 and May 1983 indicate that the pattern of recent crustal activity around the southern Kenai Peninsula has remained stable relative to the data prior to December 1981. The earthquakes are generally smaller than about magnitude 2.5. Most of the activity occurred east of the Border Ranges fault, and several concentrations can be observed in an otherwise diffuse distribution of activity. In general there is a poor correlation of the shallow activity with mapped fault traces. A more reliable estimate of the depth to the Benioff zone beneath Bradley Lake can be made from the greater number of available hypocenters of well-recorded earthquakes now available. Using the current velocity model, the depth to the top of the Benioff zone is 37 +- 5 km. A strong-motion record was obtained from the SMA-1 instrument co-located at the site of the central high-gain station BRLK, about 2 km from the proposed dam site. A preliminary estimate of 0.14 g (1 g = 980 cm/sec^2) was ob-

tained for the maximum peak-to-peak horizontal acceleration on the record, but at present the event which caused the trigger is uncertain. Two new stations were installed southeast of Kachemak Bay in June 1983 in order to improve the accuracy of hypocenter determinations for continuing shallow earthquake activity that is observed in this area. 12 refs., 9 figs., 3 tabs.

5803 Mineralogy, Petrology, And Rock Mechanics

REFER ALSO TO CITATION(S) 25260, 25312, 25319, 26226

26234 (BMI/OCRD—18) Interim rock mass properties and conditions for analyses of a repository in crystalline rock. Tammemagi, H.Y.; Chieslar, J.D. (RE/SPEC, Inc., Albuquerque, NM (USA)). Mar 1985. Contract AC02-83CH10139. 92p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85010700.

A summary of rock properties for generic crystalline rock is compiled from literature sources to provide the input data for analyses of a conceptual repository in crystalline rock. Frequency histograms, mean values and ranges of physical, mechanical, thermal, and thermomechanical properties, and the dependence of these properties on temperature are described. A description of the hydrogeologic properties of a crystalline rock mass and their dependence on depth is provided. In addition, the temperature gradients, mean annual surface temperature, and in situ stress conditions are summarized for the three regions of the United States currently under consideration to host a crystalline repository; i.e., the North Central, Northeastern, and Southeastern. Brief descriptions of the regional geology are also presented. Large-scale underground experiments in crystalline rock at Stripa, Sweden, and in Climax Stock in Nevada, are reviewed to assess whether the rock properties presented in this report are representative of in situ conditions. The suitability of each rock property and the sufficiency of its data base are described. 110 refs., 27 figs., 4 tabs.

26235 (BMI/ONWI—300) Comparison and evaluation of field and numerical results from the Site A heater test at Avery Island. Wagner, R.A. (RE/SPEC, Inc., Albuquerque, NM (USA)). Apr 1985. Contract AC06-76RL01830;AC02-83CH10140. 78p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85010625.

The primary purpose of this study was to evaluate the capability of finite element programs to calculate the thermomechanical response of salt. The Site A heater test is one of three similar field experiments which has provided data for comparison with numerical analyses. Temperature, displacements and stresses measured at Site A over a period of 500 days are compared with the calculated values. The closeness of agreement indicates that numerical techniques can simulate mechanical rock behavior in the rock salt surrounding a nuclear waste canister. The agreement is good for the comparison involving temperatures and displacements, whereas the comparison of stresses does not agree satisfactorily. 18 figs.

26236 (SAND—84-1808C) Thermal-cycle testing of the G-Tunnel heated block. Zimmerman, R.M.; Wilson, M.L.; Board, M.P.; Hall, M.E.; Schuch, R.L. (Sandia National Labs., Albuquerque, NM (USA); Science Applications International Corp., Las Vegas, NV (USA)). 1985. Contract AC04-76DP00789. 14p. (CONF-850671—12). NTIS, PC A02/MF A01; GPO Dep. File Number DE85008408.

From 26. U.S. symposium on rock mechanics; Rapid City, SD, USA (26 Jun 1985).

The measurements in the G-Tunnel heated block showed: The thermal-expansion coefficient for constant stress temperature increases had a range of 5.0 to 8.7 x 10^{-6} $^{\circ}C^{-1}$, and values compared well with a laboratory range of 6.4 to 8.0 x 10^{-6} $^{\circ}C^{-1}$. Single-fracture permeabilities were relatively insensitive to stress and slightly sensitive to temperature increases under representative in situ conditions. Excavation effects showed the most influences. The measurements ranged from 49 to 956 x 10^{-8} cm^2. Moisture contents varied from 55 to 70% saturation before heating to 15% after heating as measured with a neutron probe. There was a pronounced temperature dependence above 90°C.

26237 (SAND—84-2020C) Measurement and calculation of the mechanical response of a highly fractured rock. Bauer, S.J.; Thomas, R.K.; Ford, L.M. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 8p. (CONF-850671—13). NTIS, PC A02/MF A01; GPO Dep. File Number DE85008421.

From 26. U.S. symposium on rock mechanics; Rapid City, SD, USA (26 Jun 1985).

We have completed the first steps in attempting to validate a material constitutive model for a jointed rock mass. The continuum model, as utilized here within a finite element code, consists of a material constitutive description based on the linear elastic behavior of the matrix material and nonlinear normal and shear behavior of fracture planes. The validation exercise consists of (1) characterizing an appropriate physical model, (2) measuring the mechanical response of that physical model, and (3) using the physical model characteristics to calculate the mechanical response of the physical model. Calculated and measured responses for small-scale physical models (thermally-fractured granite) are in qualitative agreement. For deviatoric loadings, the calculated tangent modulus is an order of magnitude less than that of the matrix and exhibits stiffening with increasing a load, and thereby functionally tracks the measured response. 7 figures.

26238 (SAND—84-2021C) Implications about in situ stress at Yucca Mountain. Bauer, S.J.; Holland, J.F.; Parrish, D.K. (Sandia National Labs., Albuquerque, NM (USA); Technadyne, Albuquerque, NM (USA); RE/SPEC, Inc., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 9p. (CONF-850671—7). NTIS, PC A02/MF A01; GPO Dep. File Number DE85008068.

From 26. U.S. symposium on rock mechanics; Rapid City, SD, USA (26 Jun 1985).

Volcanic tuffs under Yucca Mountain on the Nevada Test Site (NTS) are being considered as potential media for geologic disposal of radioactive waste. Calculations in support of site evaluation, repository design, and performance assessment require accurate estimates of the in situ stresses and the variability in the stress state within Yucca Mountain. This paper uses the regional geologic studies that pertain to the stress state at the NTS, stress measurements at Yucca Mountain, and stress measurements in nearby Rainier Mesa, in conjunction with finite element calculations to estimate the in situ stresses at Yucca Mountain. Based on these data, values of lateral earth-stress coefficients (K_o) in the range $0.3 < K_o < 0.8$ are reasonable for repository depths in thermomechanical analyses. 5 figs.

26239 (SAND—84-2145C) Analysis of the elastic and strength properties of Yucca Mountain tuff, Nevada. Price, R.H.; Bauer, S.J. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 9p. (CONF-850671—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85006975.

From 26. U.S. symposium on rock mechanics; Rapid City, SD, USA (26 Jun 1985).

A large data base from more than 100 experiments on drillhole core samples of Yucca Mountain silicic tuff has been assembled. These data have been analyzed and empirical expressions were found which relate elastic properties and strength with porosity plus clay content. These relationships are presented here, in addition to an application of simple elastic composite theory to explain the observed variation of bulk modulus with functional porosity. 4 figs.

26240 (UCID—20412) Physical and chemical changes to rock near electrically heated boreholes at Spent Fuel Test-Climax. Beiriger, J.M.; Durham, W.B.; Ryerson, F.J. (Lawrence Livermore National Lab., CA (USA)). Jan 1985. Contract W-7405-ENG-48. 32p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85010834.

Sections of Climax Stock quartz monzonite taken from the vicinity of two electrically heated boreholes at Spent Fuel Test-Climax (SFT-C) have been studied by scanning electron microscopy and optical microscopy for signs of changes in crack structure and in mineralogy resulting from operations at SFT-C. The crack structure, as measured by density of cracks and average crack

lengths was found not to have changed as a result of heating, regardless of distance from the heater hole. However, rock near the heater borehole sampled in the north heater drift was found to be more cracked than rock near the borehole sampled in the south heater drift. Mineralogically, the post-test samples are identical to the pre-test samples. No new phases have been formed as a result of the test. 10 refs., 6 figs., 8 tabs.

26241 (UCRL—91468) Observations of borehole deformation modulus values before and after extensive heating of a granitic rock mass. Patrick, W.C.; Yow, J.L. Jr.; Axelrod, M.C. (Lawrence Livermore National Lab., CA (USA)). Feb 1985. Contract W-7405-ENG-48. 9p. (CONF-850671—10). NTIS, PC A02/MF A01; GPO Dep. File Number DE85008297.

From 26. U.S. symposium on rock mechanics; Rapid City, SD, USA (26 Jun 1985).

An extensive campaign of in situ deformation modulus measurements was recently completed using a standard NX borehole jack. These results were obtained in a granite intrusive where spent nuclear-fuel assemblies and electrical heaters had raised the rock temperatures 10°C to 40°C above ambient. We present an analysis of temperature effects based on 41 preheat and 63 post-heat measurements in three boreholes. Using analysis of covariance statistical techniques, we found that the deformation modulus is affected by heat, loading direction, and position within the borehole. The analysis also uncovered a significant interaction between the effects of heating and loading direction. We used 123 measurements from the same boreholes to evaluate the "Draft Standard Guide for Estimating the In Situ Modulus of Rock Masses Using the NX-Borehole Jack" which was recently proposed by Heuze. In particular, we examined the criterion for screening measurements in those cases where contact between the jack platen and the borehole wall was incomplete. We found that the proposed screen appears to operate randomly on the data and is therefore ineffective. 3 figs., 1 tab.

26242 (UCRL—92316) Improved model for fluid-driven cracks in jointed rock. Shaffer, R.J.; Ingraffea, A.R.; Heuze, F.E. (Lawrence Livermore National Lab., CA (USA); Cornell Univ., Ithaca, NY (USA)). 1985. Contract W-7405-ENG-48. 9p. (CONF-850671—14). NTIS, PC A02/MFA01; GPO Dep. File Number DE85008963.

From 26. U.S. symposium on rock mechanics; Rapid City, SD, USA (26 Jun 1985).

The finite element model FEFFLAP (Finite Element Fracture and Flow Analysis Program) is being developed for and applied to hydrofracture analyses in support of the Unconventional Gas Recovery Program at the Lawrence Livermore National Laboratory. The major characteristics of FEFFLAP were presented earlier. Two improvements made to the model are presented here: a multiple load capability and a selection of minimum aperture for fluid flow. The results of two verification and example problems are also given. 6 refs., 7 figs.

26243 (UCRL—92355) Multiphase continuum model to describe dynamic loading effects in nonlinear porous media. Swift, R.P.; Burton, D.E.; Bryan, J.B.; Glenn, H.D. (Lawrence Livermore National Lab., CA (USA)). Mar 1985. Contract W-7405-ENG-48. 15p. (CONF-850614—5). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010102.

From ASME-ASCE fluids engineering conference and joint mechanics conference; Albuquerque, NM, USA (24 Jun 1985).

A multiphase constitutive model that couples nonlinear deformation to porous flow has been developed for numerical analyses of dynamic behavior of geological media. The model has been incorporated into the explicit finite-difference code TENSOR and applied to examine the phenomenology associated with contained explosions and nuclear surface cratering in a coral geology. For contained explosions in nearly saturated media, the model predicts a region of liquefaction to exist adjacent to the cavity. This region is markedly enhanced for the case of total saturation and the associated pore pressure buildup indicate that the stability of the residual stress field may be threatened. Based on plausible assumptions about the geology and the constitutive relations of coral, we have shown that the multiphase constitutive model can relate subsidence to calculational parameters such as peak effective stress. Most of the observed volume of the Koa crater at the Pacific Proving Grounds can be accounted for by late time consolidation of the damaged coral. 21 refs., 10 figs.

26244 Memory aspects of salt creep. Lindner, E.N.; Brady, B.H.G. (Univ. of Minnesota, Minneapolis). pp 241-273 of Mechanical behavior of salt. Hardy, H.R. Jr.; Langer, M. (eds.). Clausthal, Germany, F.R.; Trans Tech Publications (1984). (CONF-811131—).

From 1. conference on the mechanical behavior of salt; University Park, PA, USA (9 Nov 1981).

This paper is concerned with the influence of load history on the creep deformation of halite, and reports some results of an analytical and experimental study of this aspect of halite deformation behavior. As a starting point, probable deformation mechanisms of halite within the temperature and stress domain of interest in underground excavation design are discussed. Various creep response models which have been formulated to date are presented, and limitations of these models in describing the response of salt to variable load paths are also defined. A formulation is then presented of a simple response model for creep within a consistent theoretical framework. The model accounts for currently assumed influences on creep behavior, including an elastic recovery, strain/time memory and fading memory. Using a series of hypothetical tests, differences in response associated with the various expressions of material memory are demonstrated. In addition, the design of a laboratory facility to conduct an investigation of salt memory properties is described. The facility is designed to subject slat specimens to triaxial stress conditions up to 35 MPa at controlled temperatures between 23° and 250°C.

26245 Analysis of long-term creep tests on model pillars. Russell, J.E.; Lomenick, T.F. (Texas A and M Univ., College Station). pp 355-368 of Mechanical behavior of salt. Hardy, H.R. Jr.; Langer, M. (eds.). Clausthal, Germany, F.R.; Trans Tech Publications (1984). (CONF-811131—). Contract W-7405-ENG-26.

From 1. conference on the mechanical behavior of salt; University Park, PA, USA (9 Nov 1981).

This paper reports on the data reduction and analysis of the long-term model pillar constant-load creep tests in progress at Oak Ridge National Laboratory (ORNL). The longest test began on July 13, 1964 on a salt sample from Lyons, Kansas. Two model pillars of salt from the Asse Mine in the Federal Republic of Germany have been under load since the fall of 1967 and two model pillars of salt from Whiskey Island in Ohio have been under load since August 26, 1971. All of the tests are at room temperature except Sample 90 from Asse that has been maintained at 100°C. All of the model pillars were prepared from 150 mm (6 in.) core with pillar width-to-height ratios of 4. The load on each sample is maintained at a constant value such that the initial average pillar stress was 28 MPa (4000 psi) except the Lyons sample where the initial stress was 41 MPa (6000 psi). The most interesting feature of the data is the episodic nature of the long-term creep, i.e., occasional periods of transient creep occur after which the rate again slows down. This phenomenon occurs in all five of the long-term tests, but is not observed in shorter tests.

26246 Specimen size and history effects on creep of salt. Senseny, P.E. (RE/SPEC Inc., Rapid City, SD). pp 369-379 of Mechanical behavior of salt. Hardy, H.R. Jr.; Langer, M. (eds.). Clausthal, Germany, F.R.; Trans Tech Publications (1984). (CONF-811131—). Contract AC06-76RL01830.

From 1. conference on the mechanical behavior of salt; University Park, PA, USA (9 Nov 1981).

Analysis of constant-stress triaxial compression laboratory experiments shows the influence of specimen size and stress history on the creep deformation of natural rock salt. Statistical methods are used to determine the influence of specimen size. Results show that during transient creep, while the specimen is hardening, deformation of smaller specimens is a stronger function of stress, temperature, and time than is deformation of larger specimens. During steady-state creep, however, specimen size has no influence. The effect of stress history on creep deformation is assessed qualitatively. Test results show that following a stress increase, a decelerating transient that approaches steady state is observed. However, following a stress decrease, an accelerating transient followed by

either steady state or a decelerating transient is observed. The steady-state strain rate does not depend on stress history, indicating that salt has a fading memory.

26247 In situ testing of salt in a deep borehole in Utah. Nelson, R.A.; Kocherhans, J.G. (Woodward-Clyde Consultants, San Francisco, CA). pp 493-510 of Mechanical behavior of salt. Hardy, H.R. Jr.; Langer, M. (eds.). Clausthal, Germany, F.R.; Trans Tech Publications (1984). (CONF-811131—).

From 1. conference on the mechanical behavior of salt; University Park, PA, USA (9 Nov 1981).

Deep in situ stress-strain, short-term creep, and hydraulic fracture tests were conducted within a bedded salt deposit at 3130 to 4945 feet depth. Field testing in an uncased borehole was accomplished using inflatable, straddle-packer (oilfield-type) test equipment. Salt's moderate deformability and negligible permeability permitted direct measurement of deep test zone volume change. Unloading tests (decreasing test zone pressure) showed that: (1) volumetric strain (borehole squeeze) increased as test zone pressure was decreased; (2) volumetric strain at a given magnitude of pressure reduction increased with depth; and (3) short-term creep rate increased by an order of magnitude with depth. Loading/hydraulic fracture tests (increasing test zone pressure) showed that the vertical and minimum horizontal stress gradients were equal to approximately 1.15 psi/foot of depth and the maximum horizontal stress was 1.5 times greater.

26248 Corejacking test for measuring salt response. Van Sambeek, L.L. (RE/SPEC Inc., Rapid City, SD). pp 527-538 of Mechanical behavior of salt. Hardy, H.R. Jr.; Langer, M. (eds.). Clausthal, Germany, F.R.; Trans Tech Publications (1984). (CONF-811131—).

From 1. conference on the mechanical behavior of salt; University Park, PA, USA (9 Nov 1981).

A test procedure was developed for measuring the response of salt subject to controlled load and temperature boundary conditions. The test consists of externally loading a hollow cylinder of salt and monitoring the elastic and time-dependent deformation of the inner borehole. The salt cylinder is a hollow core of 1 m outside diameter, 0.2 m inside diameter, and 1 m length. The test is considered a field measurement because the core is not removed after drilling and is tested in place. Loading of the core is accomplished using corejacks (curved metal flatjacks). Heaters in the annulus allow for measurements at elevated temperature. Tests were performed for constant corejack pressures of 10.6 MPa and 14.8 MPa both at ambient (27°C) and 60°C temperatures. Earlier, two tests were also performed with incremental loadings (1.7 MPa per step). The borehole closures from the constant load tests are compared with a prior finite element predictions. The creep law used in the finite element calculations was developed from laboratory creep tests on 50-mm-diameter specimens.

26249 In situ response of rock salt to cyclic loads. Thoms, R.L.; Gehle, R.M. (Louisiana State Univ., Baton Rouge). pp 539-551 of Mechanical behavior of salt. Hardy, H.R. Jr.; Langer, M. (eds.). Clausthal, Germany, F.R.; Trans Tech Publications (1984). (CONF-811131—).

From 1. conference on the mechanical behavior of salt; University Park, PA, USA (9 Nov 1981).

Cyclic pressurization tests of boreholes in salt mines are described. Data indicate rock salt is approximately linear in its response to short-term cyclic loads, but exhibits displacements bounded by long-term creep effects. Hydraulic fracturing tests between boreholes imply previously fractured reservoirs in salt retain significant pressure-holding capacities dominated by magnitude of overburden.

26250 Evaluation of room stability. McClain, W.C.; Fossum, A.F. (RE/SPEC Inc., Rapid City, SD). pp 709-715 of Mechanical behavior of salt. Hardy, H.R. Jr.; Langer, M. (eds.). Clausthal, Germany, F.R.; Trans Tech Publications (1984). (CONF-811131—).

From 1. conference on the mechanical behavior of salt; University Park, PA, USA (9 Nov 1981).

As a part of technology development in support of the program to establish a radioactive waste repository in salt deposits, a recent effort has been made to appraise the current capability to predict the stability of mined rooms in salt. This effort involved assemblying a group of experts having either broad experience in computer simulation of the structural behavior of excavations in salt or long practical experience in the design and operation of producing salt mines. The group examined in particular the solutions of a number of hypothetical room stability problems in a salt repository and compared the predicted response with the expected behavior based upon practical experience. Based on this approach, it was concluded that the current models provide a reasonably reliable qualitative overall picture of the room behavior but that the quantitative evaluation of the room stability is still very limited. This review also served to identify a number of model weaknesses and deficiencies that are suitable targets for immediate further development. The full report of this working group will be published by BMI/ONWI in late 1981.

26251 Structural petrology of experimentally deformed synthetic rocksalt. Friedman, M.; Dula, W.F.; Gangi, A.F.; Gazonas, G.A. (Texas A and M Univ., College Station). pp 19-36 of Mechanical behavior of salt. Hardy, H.R. Jr.; Langer, M. (eds.). Clausthal, Germany, F.R.; Trans Tech Publications (1984). (CONF-811131—).

From 1. conference on the mechanical behavior of salt; University Park, PA, USA (9 Nov 1981).

Warm-pressed cylinders of synthetic rocksalt, shortened 10% at $10^{-4}s^{-1}$, confining pressures (P/sub c/) from 0 to 200 MPa, and temperatures from 25° to 300°C are studied microscopically to characterize their mechanical behavior. Upon deformation (1) a-axis fabrics are not altered; (2) grain-boundary bubbles and tubes tend to become aligned along the boundaries particularly when allowed to stress relax at 200° and 300°C; (3) their connectivity increases in part by hydraulic fracturing; (4) intragranular cubic fluid inclusions are complexly modified in size, abundance, and distribution under different sets of P and T conditions; (5) slip occurs on (110)<110>; and (6) subgrain size (d, μm) is inversely proportional to steady-state stress (σ, MPa) as: $d = (146 +/- 27)\sigma^{-1}$ with rms error = +/- 3.5 μm. This relation is independent of P/sub c/ (20 to 200 MPa), and probably also of temperature (100 to 300°C), stress relaxation (to 1800 s) and the addition to data from experimentally deformed natural rocksalt. Synthetic and natural rocksalt deform by similar deformation mechanisms despite differences in grain size (0.30 mm versus 1.0 to 20 cm, respectively) and impurity content.

26252 Transient and steady-state deformation of synthetic rocksalt. Gangi, A.F.; Parrish, D.K.; Handin, J. (Texas A and M Univ., College Station). pp 37-51 of Mechanical behavior of salt. Hardy, H.R. Jr.; Langer, M. (eds.). Clausthal, Germany, F.R.; Trans Tech Publications (1984). (CONF-811131—).

From 1. conference on the mechanical behavior of salt; University Park, PA, USA (9 Nov 1981).

Synthetic rocksalt with a porosity less than 2.5% and an average grain size of about 0.35 mm was made by warm-pressing at 100°C and 150 MPa for 15 minutes. Cylinders of this material, 25 mm in diameter by 50 mm long, were deformed at strain rates of 0.1 Ks^{-1} at confining pressures of 20, 50, 100 and 200 MPa and at temperatures of 100, 200 and 300°C. The resulting stress/time data show transient-stress behavior before the steady-state appears to be reached at 10% strain where most tests ended. The stress/time data are essentially insensitive to confining pressure at constant temperature. The differential stress at 10% varies from about 25 MPa at 100°C to about 6 MPa at 300°C. These strengths are slightly less than those measured by Heard [1972] (also on synthetic, polycrystalline rocksalt) but are similar to those measured by Wawersik and Hannum [1980] and by Hansen and Mellegard [1980] on coarse-grained, natural rocksalt under similar pressure and temperature conditions. Activation energies computed from these steady-state stresses vary between 7.5 and 25 Kcal/mol and are consistent with those obtained earlier by Heard [1972] and by Parrish and Gangi [1981]. The stress/time data were fit for one- and two-mechanism, transient-stress functions. The rms errors decrease from about 1 MPa for the one-mechanism fits to about 0.2 MPa for the two-mechanism fits, strongly suggesting that at least two processes are acting. The so-called steady-state of the creep (stress-time curve)

may instead reflect the taking over by a second transient-stress mechanism with a time constant that is long relative to the duration of the test.

26253 Creep of Avery Island rocksalt. Hansen, F.D.; Carter, N.L. (RE/SPEC Inc., Rapid City, SD). pp 53-69 of Mechanical behavior of salt. Hardy, H.R. Jr.; Langer, M. (eds.). Clausthal, Germany, F.R.; Trans Tech Publications (1984). (CONF-811131—). Contract AC06-76RL01830.

From 1. conference on the mechanical behavior of salt; University Park, PA, USA (9 Nov 1981).

Thirty-six triaxial creep experiments on 50-mm-diameter cylinders of Avery Island domal rocksalt have been carried out in compression at pressures greater than 3.4 MPa, temperatures in the interval 24° to 200°C and constant stress differences in the range 2.5 to 31.0 MPa. Test durations were sufficient to achieve steady-state flow in most runs and the entire data set was fit to a Webster et al. (1969) creep equation, excluding the instantaneous elastic and plastic strain term, epsilon/sub o/. Transient creep data are fit well by the exponential decay term and steady-state data, in the temperature range 100° to 200°C, are well represented by epsilon/sub ss/ $= 7.6 \times 10^{-4} \exp(-15.9/RT10^{-3})\sigma^{4.5}$ where the activation energy, 15.9, is expressed in kcal/mol and the stress is given in MPa. In this temperature range, recovery occurs predominantly by cross-slip and diffusion-controlled dislocation climb with the resulting subgrain diameter being inversely proportional to stress (Carter et al., 1982). As applied to average subgrain size for in situ Avery Island rocksalt, a maximum steady-state differential stress of 1.1 MPa is estimated for the growth of the dome. These results for steady-state creep, together with other considerations, are applied cursorily to physical conditions expected for an underground waste repository in rocksalt. Whereas steady-state creep should prevail at extreme conditions in the vicinity of mine rooms and waste canisters, the bulk of the rocksalt should creep in the transient regime over the time range (10^3 years) considered.

26254 Elasticity and strength of ten natural rock salts. Hansen, F.D.; Mellegard, K.D.; Senseny, P.E. (RE/SPEC Inc., Rapid City, SD). pp 71-83 of Mechanical behavior of salt. Hardy, H.R. Jr.; Langer, M. (eds.). Clausthal, Germany, F.R.; Trans Tech Publications (1984). (CONF-811131—). Contract AC06-76RL01830.

From 1. conference on the mechanical behavior of salt; University Park, PA, USA (9 Nov 1981).

This paper is a composite of results obtained from quasi-static triaxial compression experiments and petrographic studies conducted on natural rock salt from ten different locations in the US. Elastic moduli and strength properties for each salt are presented and compared to assess the variability of natural rock salt. Only room temperature data are presented. The primary material strength measures are the unconfined compressive strength, C/sub o/, and the indirect tensile strength, T/sub o/. Results show that the elastic moduli do not vary substantially among sites. However, strength varies considerably but no apparent correlation to petrographic analyses could be determined.

5804 Geochemistry

26255 (CONF-841245—2) Radionuclide mobility in the shallow portion of an active high-temperature geothermal system. Sturchio, N.C.; Seitz, M.G. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010293.

From Geochemistry of radionuclides migration; Argonne, IL, USA (3 Dec 1984).

Accurate knowledge of the behavior of radionuclides in natural rock-water systems is crucial for the prediction of the consequences of failure of a high-level nuclear waste repository. Work in progress at Argonne National Laboratory involves the detailed geochemical analysis of rock, mineral, and water samples from shallow drill holes in a thermal area of Yellowstone National Park. This study is designed to provide data that will increase our understanding of the behavior of a group of radionuclides in an environment similar to that of the near field of a high-level nuclear waste repository.

5805 Oceanography

REFER ALSO TO CITATION(S) 25306, 25314

26256 (NP—5900346) Initial core descriptions: Deep Sea Drilling Project, Leg 94, North Atlantic Ocean, June 17-August 17, 1983. (Scripps Institution of Oceanography, La Jolla, CA (USA)). 31 Aug 1984. 288p. University of California, Scripps Institute of Oceanography - Deep Sea Drilling Project, A-031, La Jolla, CA 92093. File Number TI85900346.

The report contains lithologic descriptions of drill cores obtained during Leg 94 of the Deep Sea Drilling Project (DSDP) in the North Atlantic. The objective of the project was to determine the Neogene history of paleoceanographic change in the North Atlantic as a response to global climate. (ACR)

64 PHYSICS. I.

6401 Astrophysics And Cosmology

REFER ALSO TO CITATION(S) 26361

26257 (CONF-8408132—) Solar neutrinos and neutrino astronomy. AIP conference proceedings No. 126. Cherry, M.L.; Fowler, W.A.; Lande, K. (eds.). (American Inst. of Physics, New York). 1985. 336p. American Inst. of Physics, 335 E. 45th St., New York, NY 10017. File Number TI85007006.

From Conference on solar neutrinos and neutrino astronomy; Lead, SD, USA (23 Aug 1984).

Topics covered include: present Homestake Laboratory scientific programs; understanding solar neutrino emission; new radiochemical solar neutrino experiments; other solar neutrino detectors; and neutrino astronomy. (GHT)

26258 (FNAL/Pub—84/131-A) Primordial inflation and supergravity. Olive, K.A. (Fermi National Accelerator Lab., Batavia, IL (USA)). Dec 1984. Contract AC02-76CH03000. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85009538.

The present status of supersymmetric inflationary models is reviewed. In particular, problems in finding a successful model in minimal N-1 supergravity theories are resolved in more general non-minimal theories. 26 refs.

26259 (N—85-14777) Shock-induced CO_2 loss from $CaCO_3$: implications for early planetary atmospheres. Lange, M.A.; Ahrens, T.J. (California Inst. of Tech., Pasadena (USA)). Dec 1984. 27p. (NASA-CR—174197). NTIS, PC A03/MF A01.

Recovered samples from shock recovery experiments on single crystal calcite were subjected to thermogravimetric analysis to determine the amount of post-shock CO2, the decarbonization interval and the activation energy, for the removal of remaining CO2 in shock-loaded calcite. Comparison of post-shock CO2 with that initially present determines shock-induced CO2 loss as a function of shock pressure. Incipient to complete CO2 loss occurs over a pressure range of approximately 10 to approximately 70 GPa. Optical and scanning electron microscopy reveal structural changes, which are related to the shock-loading. The occurrence of dark, diffuse areas, which can be resolved as highly vesicular areas as observed with a scanning electron microscope are interpreted as representing quenched partial melts, into which shock-released CO2 was injected. The experimental results are used to constrain models of shock-produced, primary CO2 atmospheres on the accreting terrestrial planets.

26260 (N—85-15587) Non equilibrium ionization in the local hot bubble. Arnaud, M.; Rothenflug, R.; Rocchia, R. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Nov 1984. 4p. NTIS, PC A16/MF A01.

In NASA, Goddard Space Flight Center, local interstellar medium, No. 81, 301-304p., (N—85-15539 06-90).

The existence of a local hot bubble surrounding the solar system was shown by soft X-ray surveys. The spectrum of this hot interstellar medium was measured with solid state detectors during rocket flights between 300 and 1000 eV. The good resolution of the experiment permitted to measure C V, C VI and O VII line emissivities with good accuracy. These data are used to put some constraints on a model where the emission comes from a supernova remnant expanding in a finite pressure medium. The importance of nonequilibrium ionization phenomena is shown.

26261 (N—85-15588) Large-scale bubble structure of the interstellar medium (ISM) and properties of the Local Spiral Arm (LSA). Bochkarev, N.G. (Moskovskij Gosudarstvennyj Univ. (USSR). Gosudarstvennyj Astronomicheskij Inst. "GAISh"). Nov 1984. 6p. NTIS, PC A16/MF A01.

In NASA, Goddard Space Flight Center, local interstellar medium, No. 81, 305-310p., (N—85-15539 06-90).

Bubbles which are very common structure units in the Galaxy and galaxies were examined. Collection of radio, optical, infrared and X-ray observations of the Cyg superbubble (CSB) region of the sky show that the CSB is not a single bubble object. Between 50 to 75 percent of its X-ray emission is ascribed to discrete sources. The other 25 to 50% X-ray emission, probably originates from bubbles around 8 OB associations of the region. All bubbles located within the spiral structure of Galaxy, M31 and M33 have diameter 300 pc. The large distance of stellar association from the galactic plane (GP) combined with picture of the gas distribution within the LSA shows that a Reyleigh-Taylor instability in the LSA can develop and give use to the formation of compact stellar clusters, such as the Cyg OB2 association. Development stages of the Reyleigh-Taylor instability, some peculiarities of the dust distribution and departures of the local structure from the galactic grand design suggest the absence of a spiral shockwave in the LSA.

26262 (N—85-15589) Stromgren trails of hot white dwarfs. Raymond, J.C. (Harvard-Smithsonian Center for Astrophysics, Cambridge, MA (USA)). Nov 1984. 4p. NTIS, PC A16/MF A01.

In NASA, Goddard Space Flight Center, local interstellar medium, No. 81, 311-314p., (N—85-15539 06-90).

High resolution IUE spectra of Feige 24 reveal sharp C IV absorption features at both the stellar velocity and the velocity of the interstellar lines. It was shown that the ionization zone created by Feige 24 itself accounts for the interstellar components of C IV and Si IV, and that the density of hot white dwarfs in the galaxy implies that similar ionized zones around hot white dwarfs make a significant contribution to the C IV column densities observed toward distant O and B stars. Typical white dwarf velocities of around 30 km/s and C IV ionization zone diameters less than 1 pc imply that the crossing time is comparable to the ionization time, so that nonequilibrium ionization models are required. Models of the resulting elongated trails are presented.

26263 (N—85-15591) Kinematics of nearby gas and stars. Goulet, T.; Shuter, W.L.H. (British Columbia Univ., Vancouver (Canada)). Nov 1984. 7p. NTIS, PC A16/MF A01.

In NASA, Goddard Space Flight Center, local interstellar medium, No. 81, 319-325p., (N—85-15539 06-90).

The kinematic properties of gas and stars in the solar neighborhood are described in terms of the line of sight component of a three dimensional first order Taylor series expansion of the local velocity field. The types of object analyzed are: (1) 21 cm absorbing clouds; (2) intercloud medium; (3) main sequence B-stars closer than 200 pc; (4) B-stars of luminosity class ranging from I to IV; (5) main sequence A stars; (6) K-giant stars. The least squares fitting procedure used to derive the 10 coefficients describes each of the six velocity fields was essentially the same for comparison. Marked departures from circular motion are found in most cases, but the only systematic trend is a correlation between delta u/delta x and stellar spectral type, where the gas behaves like a medium younger than the early type stars. It is indicated that the standard plane-parallel model provides a good description for the intercloud medium, but is inadequate for the absorbing clouds. A velocity ellipsoid description of the residuals is presented for each type of object. The influence of the Gould belt on local kinematics is discussed.

26264 (N—85-15592) Dark matter near the sun: simulated star counts and the Oort limit. Gilden, D.; Bahcall, J.N. (Institute for Advanced Study, Princeton, NJ (USA)). Nov 1984. 5p. NTIS, PC A16/MF A01.

In NASA, Goddard Space Flight Center, local interstellar medium, No. 81, 326-331p., (N—85-15539 06-90).

An ensemble of orbits passing through the solar position was generated for a specific mass model of the galaxy. These orbits are randomly sampled to form simulated density distributions of tracer stars perpendicular to the galactic disk. The simulated distributions are analyzed to determine the sampling errors in a self consistent derivation of the total amount of matter near the Sun (the Oort limit).

26265 (N—85-15595) Measuring EUV line emmission from the hot interstellar medium. Labov, S.; Martin, C.; Bowyer, S. (California Univ., Berkeley (USA)). Nov 1984. 5p. NTIS, PC A16/MF A01.

In NASA, Goddard Space Flight Center, local interstellar medium, No. 81, 348-352p., (N—85-15539 06-90).

In the local interstellar medium, the presence of hot gas was inferred from measurements of oxygen VI absorption in the ultraviolet, and from diffuse emission in the extreme ultraviolet (EUV) and soft X-ray regions. A spectrometer that is very sensitive to gas in this temperature range is described. The spectrometer uses an array of plane ruled gratings at grazing incidence in the extreme off plane mount. A set of Kirkpatrick-Baez mirrors focuses the conically diffracted light on to one of two microchannel plate detectors. The field of view of the instrument is 0.2 deg by 12 deg. The predicted sensitivity ranges from 50 to 200 ph/(sq cm sec str) with a resolving power of 15 to 50 over the 50 to 700 angstrom wavelength band.

26266 (N—85-15596) Theoretical studies of chromospheres and winds in cool stars. Hartmann, L. (Smithsonian Astrophysical Observatory, Cambridge, MA (USA)). Dec 1984. 9p. (NASA-CR—174204). NTIS, PC A02/MF A01.

The atmospheres of hot pre-main sequence stars are discussed along with FU Orionis winds, h alpha emission from M dwarfs, and envelopes of T Tauri stars. In addition, extended chromospheres of M supergiants and metal deficiency giants are considered.

26267 (N—85-15599) 47th Annual Meteoritical Society Meeting. (Lunar and Planetary Inst., Houston, TX (USA)). 1984. 209p. (NASA-CR—174071; CONF-8407119—). NTIS, PC A10/MF A01.

From 47. annual Meteoritical Society meeting; Albuquerque, NM, USA (30 Jul 1984).

Various topics in meteorology were discussed. Chondrites, comets, cosmic dust, irradiation effects, cosmic rays, achondrites, asteroids, and lunar crators were among the topics discussed.

26268 (N—85-15600) Asteroidal source region of ordinary chondrites. Wetherill, G.W. (Carnegie Institution of Washington, DC (USA)). 1984. 1p. (CONF-8407119—). NTIS, PC A10/MF A01.

From 47. annual Meteoritical Society meeting; Albuquerque, NM, USA (30 Jul 1984).

In Lunar and Planetary Institute, the 47th. Annual Meteoritical Society Meeting, 1p., (N—85-15599 06-91).

The final, Earth-impacting orbits of ordinary chondritic meteorites have a very special distribution. By use of visual radiant and time of fall data, as well as photographic fireball orbits (1) it is inferred that chondrite perihelia are concentrated near 1 A.U., eccentricities are usually rather high (approximately 0.5), and inclinations are low (approximately 10 deg). Velocity selection resulting from atmospheric ablation plays a significant role in determining this orbital distribution, but by no means suffices to explain it. The observed distribution is a fragile one, and can easily be destroyed by Earth and Venus perturbations. This places severe constraints on the location of the original source bodies, of which these meteorites are fragments. New calculations were made of the expected distribution of final orbits from a range of initial sources, taking into consideration close encounter planetary perturbations, secular

resonance, destruction by collision in space, and atmospheric ablation.

26269 **(N—85-15607) Atmospheric heating of meteorites: results from nuclear track studies.** Jha, R. (Physical Research Lab., Ahmedabad (India)). 1984. 1p. (CONF-8407119—). NTIS, PC A10/MF A01.

From 47. annual Meteoritical Society meeting; Albuquerque, NM, USA (30 Jul 1984).

In Lunar and Planetary Institute, the 47th. Annual Meteoritical Society Meeting, 1p., (N—85-15599 06-91).

A quantitative model to estimate the degree of annealing of nuclear tracks in mineral grains subjected to a variable temperature history was proposed. This model is applied to study the track annealing records in different meteorites resulting from their atmospheric heating. Scale lengths were measured of complete and partial track annealing, delta X sub 1 and delta X sub 2, respectively. In mineral grain close to fusion crust in about a dozen meteorites. Values of delta X sub 1 and delta X sub 2 depend on extent and duration of heating during atmospheric transit and hence on meteorite entry parameters. To estimate track annealing, the temperature history during atmospheric heating at different distances from the crusted surface of the meteorite is obtained by solving heat conduction equation in conjunction with meteorite entry model, and use of the annealing model to evaluate the degree of annealing of tracks. It is shown that the measured values of delta X sub 1 and delta X sub 2 in three of the meteorites studied are consistent with values using preatmospheric mass, entry velocity and entry angle of these meteorites.

26270 **(N—85-15615) Evolutionary history of CI and CM chondrites.** Kerridge, J.F.; Macdougall, J.D. (California Univ., Los Angeles (USA)). 1984. 1p. (CONF-8407119—). NTIS, PC A10/MF A01.

From 47. annual Meteoritical Society meeting; Albuquerque, NM, USA (30 Jul 1984).

In Lunar and Planetary Institute, the 47th. Annual Meteoritical Society Meeting, 1p., (N—85-15599 06-91).

It is now clear that several different processes have acted upon various components of carbonaceous chondrites, and that at least some of those processes occurred very early in solar system history. Because these meteorites are breccias, petrographic relationships are seldom informative about the order in which those processes took place. Nonetheless, information about such an evolutionary sequence would be of potential value in defining the nature of the source region for these meteorites. Implantation of solar wind derived noble gases into CI magnetite apparently postdated the period of aqueous activity believed to be responsible for magnetite production. Carbonate crystallization roughly coincided with one or more episodes of impact driven brecciation.

26271 **(N—85-15631) Chemical evolution of the solar nebula: a new model.** Trivedi, B.M.P. (Arizona State Univ., Tempe (USA)). 1984. 1p. (CONF-8407119—). NTIS, PC A10/MF A01.

From 47. annual Meteoritical Society meeting; Albuquerque, NM, USA (30 Jul 1984).

In Lunar and Planetary Institute, the 47th. Annual Meteoritical Society Meeting, 1p., (N—85-15599 06-91).

The common notion of a hot solar nebula from which meteoritic minerals condensed is not supported by theories of star formation. A model is developed which can give the same sequence of condensation without recourse to hot solar nebula. In this model, the solar nebula was formed from the matter ejected by the Sun during its T Tauri phase and the chemical condensation took place in this outflowing matter. Isotopic anomalies and the unique minerals found in meteorites may be explained by this model.

26272 **(N—85-15632) Homogeneous condensation of gaseous mixtures of Si, Fe, O, N, and C in relative cosmic abundance and implications for astronomical condensation.** Stephens, J.R. (Los Alamos Scientific Lab., NM (USA)). 1984. 1p. NTIS, PC A10/MF A01.

In Lunar and Planetary Institute, the 47th. Annual Meteoritical Society Meeting, 1p., (N—85-15599 05-91).

The pressure versus temperature curves for homogeneous nucleation and condensation of two gaseous mixtures with nearly relative solar abundance of Si, Fe, O, N, and C in an excess of H were determined experimentally. Mixtures of CO, Fe(CO)5, H2, SiH4, and N2O in Ar were heated behind reflected shocks in a shock tube. The nucleation and condensation, which took place in the subsequent gas-dynamic expansion (cooling phase), was monitored by light scattering and turbidity. Grain morphologies and crystalline phases present in the condensates were determined by electron microscopy. These data cast doubt on the validity of both equilibrium and classical nucleation theoretical approaches to predict homogeneous condensation in a solar nebula or stellar atmosphere.

26273 **(N—85-15633) Dynamic thermal episodes in the protosolar nebula: development of models from observations on CAI's.** Bunch, T.E.; Chang, S.; Cassen, P.; Hollenbach, D. (National Aeronautics and Space Administration, Moffett Field, CA (USA). Ames Research Center). 1984. 1p. (CONF-8407119—). NTIS, PC A10/MF A01.

From 47. annual Meteoritical Society meeting; Albuquerque, NM, USA (30 Jul 1984).

In Lunar and Planetary Institute, the 47th. Annual Meteoritical Society Meeting, 1p., (N—85-15599 06-91).

Evaluation of earlier observations indicated that layered rims on coarse-grained Allende CAI's were possibly the result of partial melting by ablation/drag-heating and reaction of CAI exteriors with a gas or gases of non-solar composition. Bunch and Chang reported the common occurrence of thin, fine-grained, matrix-like bands that at least partially surround rims of CAI's. Although material in these bands in general appears to be similar to matrix, SEM observations show them to be dissimilar in volatile element content, mineral composition, and grain morphology. Moreover, they appear to be related in time of formation with rim development and Na-metasomatism of CAI's. Observations indicate a short-lived but intense heating episode followed by radid cooling as the mechanism responsible for these CAI features.

26274 **(N—85-15634) Record of galactic cosmic ray flux and traffic break-ups in iron meteorites.** Regnier, S.; Lavielle, B.; Marti, K. (CEA, 33 - Bordeaux (France)). 1984. 1p. (CONF-8407119—). NTIS, PC A10/MF A01.

From 47. annual Meteoritical Society meeting; Albuquerque, NM, USA (30 Jul 1984).

In Lunar and Planetary Institute, the 47th. Annual Meteoritical Society Meeting, 1p., (N—85-15599 06-91).

Iron meteorites contain the record of the galactic cosmic ray intensity over a 100 to 1000 Myr time scale. A method was developed to calculate the cosmic ray exposure ages of iron meteorites. Discrepanices between exposure ages are discussed.

26275 **(N—85-15635) Low-energy secondary cosmic ray flux: detectors in iron meteorites.** Murty, S.V.S.; Marti, K. (California Univ., San Diego, La Jolla (USA)). 1984. 1p. (CONF-8407119—). NTIS, PC A10/MF A01.

From 47. annual Meteoritical Society meeting; Albuquerque, NM, USA (30 Jul 1984).

In Lunar and Planetary Institute, the 47th. Annual Meteoritical Society Meeting, 1p., (N—85-15599 06-91).

The cosmic ray-produced nuclides in the interiors of very large bodies are mainly due to secondary particle reactions. The records of low-energy products, specifically the neutron capture products in meteorites, may provide new information regarding multi-stage irradiation and parent body break-ups. Noble gas nuclides, in general, are the best candidates for these investigations. The troilite nodules of iron meteorites contain very low amounts of trapped gas and, because of their elemental abundance systematics of suitable target elements for low energy production of noble gas nuclides, they are ideal candidates for this purposes. Results of a study of noble gases and nitrogen in a troilite nodule of the Cape York iron are presented.

26276 **(N—85-15636) Solar cosmic ray produced neon in lunar soils and their implication for gas-rich meteorite studies.** Nautiyal, C.M.; Rao, M.N. (Physical Research Lab., Ahmedabad (India)). 1984. 1p. (CONF-8407119—). NTIS, PC A10/MF A01.

From 47. annual Meteoritical Society meeting; Albuquerque, NM, USA (30 Jul 1984).

In Lunar and Planetary Institute, the 47th. Annual Meteoritical Society Meeting, 1p., (N—85-115599 06-91).

Characteristic neon isotopic ratios, produced due to solar cosmic ray spallation (SCR) in lunar soils, are useful in deciphering and estimating the relative contributions of SCR and GCR spallation. To delineate these features, etched mineral grains from mature and immature lunar soils (14148 and 61221 respectively) were analyzed using mass spectrometry. The SF-Ne composition deduced in this work agrees with that obtained from earlier etched lunar pyroxene studies. The data points for mature soil 14148 define a line which significantly deviates from the 61221 tie line. This deviation is attributed to the presence of SCR spallation component. In this context, neon isotopic compositions (step-wise heating) in Pantar and Leighton dark portions were studied and compared with that of Fayetteville. The meteorite data points deviate significantly from the tie line joining SF-Ne and GCR (pyroxene) end points. This deviation is attributed to SCR-spallation in gas-rich chondrites.

26277 (N—85-15637) Solar wind and cosmic ray irradiation of grains and ices - application to erosion and synthesis of organic compounds in the solar system. Rocard, F.; Benit, J.; Bibring, J.P.; Vassent, B. (Paris-11 Univ., 91 - Orsay (France)). 1984. 1p. (CONF-8407119—). NTIS, PC A10/MF A01.

From 47. annual Meteoritical Society meeting; Albuquerque, NM, USA (30 Jul 1984).

In Lunar and Planetary Institute, the 47th. Annual Meteoritical Society Meeting, 1p., (N—85-15599 06-91).

Solar wind and cosmic and cosmic ray irradiation of grains induces physical and chemical effects including their erosion and the synthesis of molecular compounds within the implanted layers. The experiments performed with H2O ice implanted by keV ions are presented. The ion implantation is intended to simulate the irradiation of comets, ring grains, and satellites of outer planets, either by the primitive solar particles or by contemporary solar wind (SW) or solar cosmic rays (SCR) fluxes. The detection of molecules was obtained through in-situ infrared spectroscopy. A model is proposed for the formation of organic matter within icy solar system bodies which is in agreement with experimental results of erosion rates. The organic molecules, frozen-in within the icy mantles of the grains present in the protosolar nebula, would originate from their primitive irradiation. Such an irradiation would have taken place during an early stage of the proto-sun, when both the SW and SCR particles were more intense by orders of magnitude.

26278 (N—85-15643) Chemistry of rare earth elements in the solar nebula. Larimer, J.W.; Bartholomay, H.A.; Fegley, B. (Arizona State Univ., Tempe (USA)). 1984. 1p. (CONF-8407119—). NTIS, PC A10/MF A01.

From 47. annual Meteoritical Society meeting; Albuquerque, NM, USA (30 Jul 1984).

In Lunar and Planetary Institute, the 47th. Annual Meteoritical Society Meeting, 1p., (N—85-15599 06-91).

The high concentration of rare earth elements (REE) in primitive CaS suggests that the REE along with the other normally lithophile elements form stable sulfides under the unusual conditions which existed during the formation of enstatite chrondites. In order to acquire a more quantitative framework in which to interpret these data, the behavior of the REE in systems with solar, or slightly fractionated solar, composition is being studied. These new data introduce modest changes in the behavior of some of the REE when compared to previous studies. For example, the largest differences are in the stabilities of the gaseous monoxides of Ce, Eu, Tb, Ho, and Tm, all of which now appear to be less stable than previously thought, and YbO(g) which is somewhat more stable. Much more significant are the changes in REE distribution in the gas phase in fractionated systems, especially those made more reducing by changing the C/O ratio from the solar value of 0.6 to about 1.0. In almost all cases, the exceptions being Eu, Tm and Yb whose elemental gaseous species dominate, the monosulfides become more abundant. Moreover, the solid oxides of Eu, Tm and Yb become less stable under more reducing conditions which, in effect, should reduce the condensation temperature of all REE in more reduced systems.

26279 (N—85-15647) Discovery of nuclear tracks in interplanetary dust. Bradley, J.P.; Brownlee, D.E. (McCrone (Walter C.) Associates, Inc., Chicago, IL (USA)). 1984. 1p. (CONF-8407119—). NTIS, PC A10/MF A01.

From 47. annual Meteoritical Society meeting; Albuquerque, NM, USA (30 Jul 1984).

In Lunar and Planetary Institute, the 47th. Annual Meteoritical Society Meeting, 1p., (N—85-15599 06-91).

Prior to capture by the Earth's atmosphere individual interplanetary dust particles (IDP's) have allegedly spent up to 10 to the 5th power years as discrete bodies within the interplanetary medium. Observation of tracks in IDP's in the form of solar flare tracks would provide hitherto unknown data about micrometeorites such as: (1) whether an IDP existed in space as an individual particle or as part of a larger meteroid; (2) the degree to which a particle was heated during the trauma of atmospheric entry; (3) residence time of an IDP within the interplanetary medium; and (4) possible hints as to the pre-accretional exposure of component mineral grains to solar or galactic irradiation. Using transmission electron microscopy tracks in several micrometeorites have been successfully identified. All of the studied particles had been retrieved from the stratosphere by U-2 aircraft. Three pristine IDP's (between 5 and 15 micro m diameter) have so far been searched for solar flare tracks, and they have been found in the two smaller particles U2-20B11 (11 micro m) and U2-20B37 (8 micro m).

26280 (N—85-15652) Solar He-3-rich events and non-relativistic electron events: a new association. Reames, D.V.; Vonrosenvinge, T.T.; Lin, R.P. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Nov 1984. 27p. (NASA-TM—86179). NTIS, PC A03/MF A01.

In 15 months of observation by the ISEE-e spacecraft, it was found that virtually all solar greater than or approximately equal to 1.3 MeV/nucleon He-3-rich events are associated with impulsive 2 to approximately 100 keV electron events, although many electron events were not accompanied by detectable He-3 increases. Both the He-3 and the electrons exhibit nearly scatter-free propagation in the interplanetary medium, and the times of onset and maximum for the He-3 and electron increases are closely related by velocity dispertion. The electron events and their related type III solar radio bursts provide, for the first time, identification of the flares which produce He-3-rich events. He-3 appears to be accelerated at the flash phase of solar flares along with nonrelativistic electrons.

26281 Symmetry behavior of the static Taub universe: Effect of curvature anisotropy. Shen, T.C.; Hu, B.L.; O'Connor, D.J. (Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742). *Physical Review [Section] D: Particles and Fields;* **31**: No. 10, 2401-2423(15 May 1985).

Using the static Taub universe as an example, we study the effect of curvature anisotropy on symmetry breaking of a self-interacting scalar field. The one-loop effective potential of a λphi^4 field with arbitrary coupling (ξ) is computed by zeta-function regularization. It is expressed as a perturbative series in a small anisotropy parameter α measuring the deformation from the spherical Einstein universe with radius of curvature a. This result is used for analyzing the symmetry behavior of such a system as a function of the geometric (a,α) and field (ξ,λ) parameters. The result is also used to address the question of whether and how curvature anisotropy can affect the inflationary scenario, old or new. We find that for a massless scalar field conformally coupled to the background with a prolate configuration (negative scalar curvature) the phase transition is of second order, in which case inflation to the extent necessary for cosmological purposes becomes highly unlikely. For the massless minimally coupled scalar field, first-order phase transitions can occur for a certain range of the radius and deformation parameter. If the curvature radius in the axisymmetric direction is held fixed, increasing deformation can restore the symmetry, whereas if the shape is held constant but the size is allowed to vary, decreasing the radius of the universe can induce symmetry breaking. For the minimally coupled field in a closed universe with high curvature a term linear in the background field in the effective potential appears. The barrier thus generated in the effective potential re-

places the broad plateau of the flat-space Coleman-Weinberg potential. The meaning and implication of these results are discussed.

26282 Electric field of a pulsar magnetosphere. Smith, D.F.; Muth, L.A.; Arons, J. (Berkeley Research Associates). *Astrophysical Journal;* 289: No. 1, 165-172(1 Feb 1985).

Numerical solutions are found for the electric field of a simplified model of a radio pulsar's magnetosphere. The magnetic field assumed is that of a rotating point dipole with modulation in radius and azimuth chosen to emulate the effect of the field line sweepback expected in a full magnetospheric solution. This choice allowed an analytic solution for the noncorotation potential which was used in verifying the numerical results. The magnetic and rotation axes were assumed to be orthogonal Nonneutral beams of particles were injected along the polar field at radii r = 0.1 R/sub L/, where R/sub L/ is the light cylinder distance. The properties of these beams were chosen according to an existing theory of low-altitude particle acceleration. Nonpolar field lines were modeled as regions of corotation. Pair creation is neglected, as is appropriate for objects of sufficiently weak field and also as is appropriate for studies of the stability of a magnetosphere with respect to pair creation. Specific results are obtained for rotation period P = 0.5 and magnetic moment $\mu = 5 \times 10^{30}$ cgs. Our results show that the maximum noncorotation potential reached is 20%—35% of the full vacuum potential drop which can occur over the polar caps when the neighboring closed zone is a good conductor. This percentage increases a the assumed radius of the last closed field line is decreased below R/sub L/. The ratio 'E'/'B' was calculated to see where acceleration across B can occur, as this is an important mechanism for the formation of return currents in more realistic pulsar models.

26283 Type II supernova energetics. Lattimer, J.M.; Burrows, A.; Yahil, A. (Department of Earth and Space Sciences, State University of New York at Stony Brook). *Astrophysical Journal;* 288: No. 2, 644-652(15 Jan 1985). Contract AC02-80ER10719.

In this paper we exploit the fact that the collapsing core of a massive star, at the endpoint of its thermonuclear life, rapidly becomes hydrostatic after bouncing at nuclear densities. The energy transferred by pdV work from the inner unshocked core as it becomes hydrostatic to the bounce shock in the outer core is, to a good approximation, the initial energy of the supernova. The magnitude of this energy, which goes into the entropization, dissociation, and kinetic energy of the shocked matter, determines in large measure whether the purely hydrodynamic mechanism of Type II supernovae works. It can be shown semi-analytically that this energy is equal, with minor qualifications, to the binding energy of the hydrostatic remnant. We present analytical formulae for the structure and binding energy of a hydrostatic residue modeled as a composite of two nested polytropes. It is shown that the binding energy of such a configuration, when taken as a function of mass, is independent of the details of the equation of state of the stiff inner polytrope and hence insensitive to the poorly known nuclear equation of state. The nuclear physics enters directly mainly through the ratio of pressure to density at the transition density where matter becomes stiff. Since all the relevant masses of the remnant can be determined by self-similar or hydrostatic analysis, th initial shock energy can be derived without recourse to hydrodynamic calculation. This perspective allows us to extract most of the essentials of bounce energetics.

26284 Some observable indicators of s-process environments. Despain, K.H. (Los Alamos National Lab., NM (USA)). pp 195-198 of Observational tests of the stellar evolution theory. Proceedings of the IAU symposium no. 105 held in Geneva, Switzerland, September, 12-16, 1983. Maeder, A. (Geneva Observatory, Sauverny (Switzerland)); Renzini, A. (Bologna Univ. (Italy)) (eds.). Dordrecht, Netherlands; D. Reidel (1984). (CONF-8309172—).

From IAU symposium on observational tests of stellar evolution theory; Geneva, Switzerland (12 Sep 1983).

Also published in paperback ISBN 90-277-1775-3.

By definition, the chemically peculiar stars have element abundances that are non-solar. Many of these stars show peculiarities in s-process elements. The author discusses observable indicators of the neutron environment for the s-process in these stars.

26285 Constraints on stellar evolution from pulsations. Cox, A.N. (Los Alamos National Lab., NM (USA)). pp 421-440 of Observational tests of the stellar evolution theory. Proceedings of the IAU symposium no. 105 held in Geneva, Switzerland, September, 12-16, 1983. Maeder, A. (Geneva Observatory, Sauverny (Switzerland)); Renzini, A. (Bologna Univ. (Italy)) (eds.). Dordrecht, Netherlands; D. Reidel (1984). (CONF-8309172—).

From IAU symposium on observational tests of stellar evolution theory; Geneva, Switzerland (12 Sep 1983).

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Consideration of the many types of intrinsic variable stars, that is, those that pulsate, reveals that perhaps a dozen classes can indicate some constraints that affect the results of stellar evolution calculations, or some interpretations of observations. Many of these constraints are not very strong or may not even be well defined yet. The author discusses the case for six classes: classical Cepheids with their measured Wesselink radii, the observed surface effective temperatures of the known eleven double-mode Cepheids, the pulsation periods and measured surface effective temperatures of three R CrB variables, the delta Scuti variable VZ Cnc with a very large ratio of its two observed periods, the nonradial oscillations of the Sun, and the period ratios of the newly discovered double-mode RR Lyrae variables.

26286 Phase separation in a chondrule fragment from the Piancaldoli (LL3) chondrite. Planner, H.N. Los Alamos, NM; Los Alamos National Laboratory ([1985]). 8p.

A chondrule fragment has been found in the Piancaldoli (LL3) chondrite that contains prolate silica spheroids embedded in a matrix with an approximate low-Ca pyroxene (Fs14) composition. Although compositional and textural evidence supports metastable coexistence of two liquid phases, neither phase is preserved as glass. The matrix has a fan-spherulitic texture, and many of the silica spheroids contain dendritic cristobalite. Silica interdendrite voids near the two-phase interface do not modify the smooth curvilinear outline of the interface, indicating that the iron magnesium silicate matrix had congealed prior to cristobalite crystallization from the silica-rich phase. Available data suggest that this immiscibility is formed upon cooling from the melt. A temperature near 1275°-1300°C, based on phase composition, is thought to be the temperature at which these coexisting liquids last approached metastable equilibrium.

6402 Atmospheric Physics

26287 (AD-A—149573/8/XAB) Principles of magnetospheric ion composition. Technical report. Schulz, M. (Aerospace Corp., El Segundo, CA (USA). Space Sciences Lab.). 17 Dec 1984. 50p. (TR—0084A(5940-06)-1). NTIS, PC A03/MF A01.

Ion composition provides an important diagnostic tool for identifying and quantifying source, loss, energization, and transport processes applicable to magnetospheric charged particles. However, the situation is not as simple as had been envisioned a decade ago. Ring-current and radiation-belt ions are believed to come from either the sun or the earth's ionosphere or both. Entry is not direct in either case. Solar-wind velocity and ion composition vary considerably with time. Ion-velocity distributions are partially thermalized in the magnetosheath after crossing the bow shock. Entry of solar-wind ions into the magnetosphere is modulated in part by reconnection efficiency, i.e., by the ratio of cross-tail electric field to asymptotic interplanetary electric field. Non-adiabatic motion in the plasma sheet may enable the crosstail electric field to heat the various ion species by different amounts. Entry of ionospheric ions into the plasma sheet seems to occur primarily through afternoon- and evening-sector auroral arcs, rather than through the polar wind as has previously been postulated. Energization occurs through interaction with the auroral potential structure (which varies with magnetic activity) and through plasma-sheet processes cited above.

26288 (AD-A—149725/4/XAB) S3-3 ONR-118 data analysis. Final report, 1 June 1978-31 October 1984. Sharp, R.D.; Shelley, E.G.; Johnson, R.G.; Collin, H.L.; Ghielmetti, A.G. (Lockheed Palo Alto Research Labs., CA (USA)). 31 Oct 1984. 38p. NTIS, PC A03/MF A01.

Original contains color plates: All DTIC and NTIS reproductions will be in black and white.

This report describes results of the ONR-118 instrument flown on the S3-3 satellite launched in July 1976 into a near polar orbit with apogee of 8,000 km. The instrument measured ion composition in the energy range E/Q = 0.5-16 keV/e, and electron fluxes in four bands between .07-24 keV. Principal results in the period of this contract addressed the acceleration of ionospheric ions and their trapping in the magnetosphere; the observation of narrow electron beams; and the characterization and modeling of auroral acceleration region. Energetic ions were observed resulting from both quasistatic electric fields and mass-dependent transverse acceleration. Properties of ion outflow were examined as a function of latitude, local time, altitude, magnetic activity, and solar-cycle phase. Electron beams were observed closely clustered in latitude with upflowing ions, and with apparent source location at altitudes at or above 1 RE. In the case of counterstreaming eleotrons, observations implied a source in multiple flickering double layers. The distributions of different ion species have been used in studies of wave growth stability and wave particle interactions, the morphology and dynamics of auroral processes, and the transport processes involved in magnetosphere-ionosphere coupling.

26289 (AD-A—149728/8/XAB) SCATHA (Spacecraft Charging at High Altitudes) plasma interaction experiment: SC-3 High Energy Particle Spectrometer; SC-8 Energetic Ion Composition Experiment. Final report, 1 November 1975-30 October 1984. Shelley, E.G.; Sharp, R.D.; Nightingale, R.W.; Quinn, J.M. (Lockheed Palo Alto Research Labs., CA (USA)). 30 Nov 1984. 53p. NTIS, PC A04/MF A01.

This report describes the results of the SC-3 (High Energy Particle Spectrometer) and SC-8 (Energetic Ion Composition Experiment) instruments flown on the SCATHA (Spacecraft Charging at High Altitudes) satellite, launched in January 1979 into a near geosynchronous orbit. The instruments measure electrons at energies of 0.05-5.0 MeV, protons of 1-100 MeV, and mass composition of ions in the range E/q=0.1-32 keV/e. Both instruments continue to be fully operational at this time. Principal results of the High Energy Particle Spectrometer have addressed radial profiles and energy spectra of energetic particles, the role of energetic particles in the charging and discharging of spacecraft dielectrics, the behavior of trapped electrons at flux levels near the Kennel-Petchek trapping limit, and the precipitation of energetic electrons into the ionosphere. The Energetic Ion Composition Experiment has provided the first ion composition data with routine pitch-angle coverage in the vicinity of geosynchronous orbit. The advances resulting from this instrument can be grouped into four categories: (1) plasma injection and transport, (2) detailed structure of near-geosynchronous plasma distributions, (3) interactions between hot plasmas and spacecraft, and (4) global understanding arising from the synthesis of individual results.

26290 (AD-A—150752/4/XAB) Downshift of electron plasma oscillations in the electron-foreshock region. Progress report. Fuselier, S.A.; Gurnett, D.A.; Fitzenreiter, R.J. (Iowa Univ., Iowa City (USA). Dept. of Physics and Astronomy). 10 Oct 1984. 54p. (U-OF-IOWA—84-21). NTIS, PC A04/MF A01.

Sponsored in part by Grant NGL-16-001-043.

Electron plasma oscillations in the Earth's electron-foreshock region are observed to shift above and below the local electron plasma frequency. As plasma oscillations shift downward from the plasma frequency, their bandwidth increases and their wavelength decreases. Observations of plasma oscillations well below the plasma frequency are correlated with times when ISEE-1 is far downstream of the electron-foreshock boundary. Although wavelengths of plasma oscillations below the plasma frequency satisfy k(lambda)De approximately = 1, the Doppler-shift due to the motion of the solar wind is not sufficient to produce the observed frequency shifts. A beam-plasma interaction with beam velocities on the order of the electron thermal velocity is suggested as an explanation for plasma oscillations above and below the plasma frequency. Frequency, bandwidth, and wavelength changes predicted from the beam-plasma interaction are in good agreement with the observed characteristics of plasma oscillations in the foreshock region.

26291 (AD-A—150927/2/XAB) Three-dimensional plasma observations near the outer magnetospheric boundary. Report for 1977-1979. Eastman, T.E.; Popielawska, B.; Frank, L.A. (Iowa Univ., Iowa City (USA). Dept. of Physics and Astronomy). Jan 1982. 72p. (U-OF-IOWA—82-8). NTIS, PC A04/MF A01.

Detailed analyses of 18 ISEE-1 magnetopause crossings have been made using three-dimensional plasma data obtained by the University of Iowa LEPEDEAs which detect ions and electrons from 1 eV to 45 keV over all. Crossings were examined that occurred on both the dawn and dusk flanks near the sunward, outer magnetospheric boundary. Nearly all cases show a de-energization of magnetosheath plasma after this plasma crosses the magnetopause to produce the magnetospheric boundary layer. The bulk plasma flow frequently changes direction as it crosses the magnetopause resulting in boundary layer flow that has an enhanced cross-field flow component without, typically, any increase speed. Three-dimensional observations of plasma flow demonstrate that these polarization fields are present and significant. A few exceptional crossings do show plasma energization in the boundary layer, a condition that occasionally results from Maxwell stresses on impulsively injected magnetosheath plasma. However, some principal cases of such energized plasma appear to occur on closed field lines so that the reconnection mechanism is not necessarily involved in these exceptional crossings. The reconnection hypothesis also predicts that plasma is energized at the expense of field energy density. However, this study demonstrates that the dominant process in the solar wind-magnetosphere interaction results in plasma de-energization as magnetosheath plasma crosses the magnetopause to supply the magnetospheric boundary layer.

26292 (AD-A—151072/6/XAB) Active Magnetospheric Particle Tracing Explorers (AMPTE). Annual letter report, 1 December 1983-30 November 1984. Anderson, R.R. (Iowa Univ., Iowa City (USA)). 7 Feb 1985. 10p. NTIS, PC A02/MF A01.

The primary purposes of the Active Magnetospheric Particle Tracing Explorers (AMPTE) program are (1) to carry out the release and monitoring of lithium and barium ions in the solar wind and within the distant magnetosphere in order to study the access of solar wind ions to the magnetosphere, the convective-diffusive transport and energization of magnetospheric particles, and the instabilities and wave-particle interactions associated with the releases and the subsequent evolution of the injected clouds, and (2) to generate massive releases of barium in the dawn magnetosheath in order to create visible artificial comets in the flowing solar wind plasma within which studies of diamagnetic effects, ionization, momentum exchange, ion transport, and visible phenomena can be made. Complete descriptions of the three spacecraft involved in the AMPTE program, the Charge Composition Explorer (CCE), the Ion Release Module (IRM), and the United Kingdom Subsatellite (UKS) and the experiments on the spacecraft will be included in the May 1985 issue of IEEE Transacations on Geoscience and Remote Sensing. The AMPTE program is a collaborative effort involving the United States, the Federal Republic of Germany, and the United Kingdom.

26293 (LA-UR—85-1303) Solar wind-magnetosphere energy input functions. Bargatze, L.F.; McPherron, R.L.; Baker, D.N. (California Univ., Los Angeles (USA). Dept. of Earth and Space Sciences; California Univ., Los Angeles (USA). Inst. of Geophysics and Planetary Physics; Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 20p. (CONF-850277—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010761.

From Chapman conference on solar wind-magnetosphere energy coupling; Pasadena, CA, USA (12 Feb 1985).

A new formula for the solar wind-magnetosphere energy input parameter, P/sub i/, is sought by applying the constraints imposed by dimensional analysis. Applying these constraints yields a general equation for P/sub i/ which is equal to rho V^3l/sub CF/

^{2}F(M/sub A/,θ) where, rho V^2 is the solar wind kinetic energy density and l/sub CF/^{2} is the scale size of the magnetosphere's effective energy "collection" region. The function F which depends on M/sub A/, the Alfven Mach number, and on θ, the interplanetary magnetic field clock angle is included in the general equation for P/sub i/ in order to model the magnetohydrodynamic processes which are responsible for solar wind-magnetosphere energy transfer. By assuming the form of the function F, it is possible to further constrain the formula for P/sub i/. This is accomplished by using solar wind data, geomagnetic activity indices, and simple statistical methods. It is found that P/sub i/ is proportional to (rho V^2)/sup 1/6/VBG(θ) where, rho V^2 is the solar wind dynamic pressure and VBG(θ) is a rectified version of the solar wind motional electric field. Furthermore, it is found that G(θ), the gating function which modulates the energy input to the magnetosphere, is well represented by a "leaky" rectifier function such as sin^4(θ/2). This function allows for enhanced energy input when the interplanetary magnetic field is oriented southward. This function also allows for some energy input when the interplanetary magnetic field is oriented northward. 9 refs., 4 figs.

26294 (LA-UR—85-1305) Linear filters as a method of real-time prediction of geomagnetic activity. McPherron, R.L.; Baker, D.N.; Bargatze, L.F. (California Univ., Los Angeles (USA). Inst. of Geophysics and Planetary Physics; Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 16p. (CONF-850277—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010760.

From Chapman conference on solar wind-magnetosphere energy coupling; Pasadena, CA, USA (12 Feb 1985).

Important factors controlling geomagnetic activity include the solar wind velocity, the strength of the interplanetary magnetic field (IMF), and the field orientation. Because these quantities change so much in transit through the solar wind, real-time monitoring immediately upstream of the earth provides the best input for any technique of real-time prediction. One such technique is linear prediction filtering which utilizes past histories of the input and output of a linear system to create a time-invariant filter characterizing the system. Problems of nonlinearity or temporal changes of the system can be handled by appropriate choice of input parameters and piecewise approximation in various ranges of the input. We have created prediction filters for all the standard magnetic indices and tested their efficiency. The filters show that the initial response of the magnetosphere to a southward turning of the IMF peaks in 20 minutes and then again in 55 minutes. After a northward turning, auroral zone indices and the midlatitude ASYM index return to background within 2 hours, while Dst decays exponentially with a time constant of about 8 hours. This paper describes a simple, real-time system utilizing these filters which could predict a substantial fraction of the variation in magnetic activity indices 20 to 50 minutes in advance.

26295 Zero-frequency ion ring instability. Gary, S.P.; Pongratz, M.B.; Madland, C.D.; Swift, D.W. (Earth and Space Sciences Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physics of Fluids;* **28**: No. 6, 1727-1734(Jun 1985).

The electrostatic zero-frequency ion ring instability with wave vector perpendicular to a uniform magnetic field B is examined through linear and second-order theory as well as by computer simulation. In the simulation ions are taken as magnetized particles; the electrons are described as a massless fluid subject to E x B motion. Saturation of the instability is primarily due to broadening of the ion ring distribution. A second-order theory provides an approximate criterion for the saturation amplitude, as does a simple trapping argument. Thus, for the simulation presented here, both quasilinear and trapping effects contribute to saturation.

26296 Infrared measurements of atmospheric ethane (C_2H_6) from aircraft and ground-based solar absorption spectra in the 3000 cm^{-1} region. Coffey, M.T.; Mankin, W.G.; Goldman, A.; Rinsland, C.P.; Harvey, G.A.; Malathy Devi, V.; Stokes, G.M. (National Center for Atmospheric Research, Boulder, Colorado 80307). *Geophysical Research Letters;* **12**: No. 4, 199-202(Apr 1985).

A number of prominent Q-branches of the ν_7 band of C_2H_6 have been identified near 3000 cm^{-1} in aircraft and ground-based infrared solar absorption spectra. The aircraft spectra provide the column amount above 12 km at various altitudes. The column amount is strongly correlated with tropopause height and can be described by a constant mixing ratio of 0.46 ppbv in the upper troposphere and a mixing ratio scale height of 3.9 km above the tropopause. The ground-based spectra yield a column of 9.0 x 10^{15} molecules cm^{-2} above 2.1 km; combining these results implies a tropospheric mixing ratio of approximately 0.63 ppbv.

6403 Atomic, Molecular, And Chemical Physics

REFER ALSO TO CITATION(S) 25792, 25886, 26006, 26366

26297 (AD—407503/2/XAB) Mission analysis for controlled fusion propulsion system. Report for 1 February-May 1962. Cooper, R.F.; Verga, R.L. (Air Force Aeronautical Systems Div., Wright-Patterson AFB, OH (USA)). Apr 1963. 82p. NTIS, PC A05/MF A01.

Report on Advanced Concepts for Propulsion.

A discussion of the relationships existing between engine, vehicle, and mission parameters of a typical controlled-fusion propulsion (CFP) system is presented. The low specific weight obtainable with a CFP device allows extremely high payload fractions in large vehicles. The CFP system is compared with other electric propulsion systems, and the CFP system is shown to possess inherent advantages for the performance of high velocity increment that is required for the missions.

26298 (AD—408118/8/XAB) Controlled fusion for space propulsion. Report for April 1961-June 1962. Mitchell, H.M.; Cooper, R.F.; Verga, R.L. (Aeronautical Systems Div., Wright-Patterson AFB, OH (USA)). Apr 1963. 16p. NTIS, PC A02/MF A01.

Report on Advanced Concepts for Propulsion.

The feasibility of applying controlled fusion to the propulsion of space vehicles was studied. Some qualitative arguments are given to support the technical feasibility of this application. Problem areas that require solution prior to the establishment of design philosophy are also discussed. Because of the potential of a fusion-propelled space vehicle for the accomplishment of very-high-energy missions, a preliminary research program for investigating the feasibility of fusion energy for propulsion is deemed justified.

26299 (AD-A—150068/5/XAB) State-selected ion-molecule reaction dynamics. Final report, 1 November 1982-31 October 1984. Morrison, R.J.S.; Conaway, W.E.; Zare, R.N. (Stanford Univ., CA (USA). Dept. of Chemistry). 15 Dec 1984. 7p. NTIS, PC A02/MF A01.

By analyzing the photoelectron energies in several systems, it has been demonstrated that multiphoton ionization (MPI) can selectively produce molecular ions predominantly in a single vibrational level by the proper choice of the laser wavelength employed. Thus MPI provides a powerful new technique for producing high densities of internally state-selected reagent ion for chemical reaction dynamics studies. This approach is being taken for studying the ion-molecule reactions of $NH_3(+)$ (v) which has been prepared with v = 0-9 vibrational quanta in the nu_2 umbrella-bending mode.

26300 (BNL—36165) Resonant-transfer-and-excitation for highly charged ions ($16 \leq Z \leq 23$) in collisions with helium. Tanis, J.A.; Bernstein, E.M.; Oglesby, C.S.; Graham, W.G.; Clark, M.; McFarland, R.H.; Morgan, T.J.; Stockli, M.P.; Berkner, K.H.; Schlachter, A.S. (Western Michigan Univ., Kalamazoo (USA). Dept. of Physics; New Univ. of Ulster, Coleraine (UK); North Carolina Univ., Chapel Hill (USA); Missouri Univ., Rolla (USA); Wesleyan Univ., Middletown, CT (USA); Kansas State Univ., Manhattan (USA)). 1984. Contract AC02-76CH00016. 15p. (CONF-8410237—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010550.

From Workshop on atomic spectra and collisions in external fields; Gaithersburg, MD, USA (22 Oct 1984).

Results of recent investigations are presented for resonant-transfer-and-excitation (RTE) in ion-atom collisions. This process, which is analogous to dielectronic recombination (DR), occurs

when a target electron is captured simultaneously with the excitation of the projectile followed by deexcitation by photon emission. RTE, like DR, proceeds via the inverse of an Auger transition, and is resonant for projectile energies corresponding to Auger electron energies. RTE has been investigated for 70 to 160 MeV $_{16}S^{12+}$, 100 to 360 MeV $_{20}Ca$/sup 16+,17+,18+/ and 180 to 460 MeV $_{23}V$/sup 19+,20+,21+/ ions colliding with helium. The measured dependence of RTE on projectile atomic number and charge state are in reasonable agreement with theoretical calculations of RTE. The results indicate that RTE measurements should be useful in testing DR calculations, particularly for highly ionized ions. 11 refs, 6 figs.

26301 **(BNL—36348) Present and future directions of atomic physics research with multiply-charged ions at Brookhaven National Laboratory.** Jones, K.W.; Johnson, B.M.; Meron, M. (Brookhaven National Lab., Upton, NY (USA)). Mar 1985. Contract AC02-76CH00016. 24p. (CONF-841265—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010960.

From Symposium on new experiments in atomic physics using synchrotron radiation; Lund, Sweden (13 Dec 1984).

Atomic physics research with multiply-charged ions is now in progress using ion beams from the Brookhaven Double MP-Tandem van de Graaff facility. In the near future, experiments will start using ions produced by photons from the National Synchrotron Light Source (NSLS). Examples of typical experiments are discussed to illustrate the comprehensive nature of these facilities. Plans for future expansion by addition of a CRYEBIS type ion source coupled to a heavy-ion storage ring for use in crossed-beam experiments at the NSLS are discussed. 18 refs., 8 figs.

26302 **(CONF-850169—10) Positron measurements in 2H-$TaSe_2$ crystals.** Jean, Y.C.; Fluss, M.J. (Missouri Univ., Kansas City (USA). Dept. of Physics; Argonne National Lab., IL (USA)). Jan 1985. Contract W-31-109-ENG-38. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010507.

From 7. international conference on positron annihilation; New Delhi, India (6 Jan 1985).

Temperature-dependent positron annihilation lifetime and Doppler broadening experiments are reported on single crystals of 2H-$TaSe_2$ to search for effects from known charge-density-wave (CDW) phase transitions. The positron lifetime in the perfect lattice and in positron trapping sites were found to be 0.173 and 0.378 ns, respectively. The apparent activation energy for the thermally generated trapping sites was found to be 0.12 eV. Doppler broadening spectra exhibited no response to the known CDW phase transitions, nor any significant overall anisotropy in their temperature dependence.

26303 **(CONF-8403124—Pt.1) Atomic, molecular and solid-state theory, and computational quantum chemistry: proceedings. Part 1.** Loewdin, P.O.; Sabin, J.R.; Zerner, M.C. (eds.). (Wiley (John) and Sons, New York (USA)). 1984. Contract FG01-84CE90144. 735p. NTIS, PC A99/MF A01; 1; GPO Dep. File Number DE85009401.

From Sanibel symposia; Palm Coast, FL, USA (1 Mar 1984).

Abstracts of several items from the symposium were prepared separately for the data base. (GHT)

26304 (CONF-8403124—Pt.1, pp 213-235) **Factors governing electronic localization in transition metal clusters and complexes.** Logan, J.; Newton, M.D.; Noell, J.O. (Brookhaven National Lab., Upton, NY). 1984. NTIS, PC A99/MF A01. File Number DE85009401.

From Sanibel symposia; Palm Coast, FL, USA (1 Mar 1984).

Small nickel atom clusters exhibit an energetic preference for localized, open 3d-shells. This tendency is attributed to weak 3d-3d overlap and is analyzed in terms of the competition between resonance integrals and screening terms. Analogous competition between resonance and screening leads to (spatially) symmetry-broken charge-localized SCF solutions for 3d ion-hole states in nickel atom clusters. Charge-localized symmetry broken wavefunctions are also employed as initial and final diabatic (nonstationary) states in the electron transfer processes associated with transition metal complexes of the type MX_6/sup n+/, where M = Fe, Ru; X = H_2O; NH_3, n = 2,3. Resonance integrals coupling the initial (reactants) and final (products) states have been calculated for several geometrical structures and electronic states of interest. An important contributor to the screening effects which promote charge localization in these systems is the charge-dependence of metal-ligand bond lengths. The decrease in oxidation-state dependence of metal-ligand bond length in the series Fe/sup 2+/3+/$(H_2)_6$ → Ru/sup 2+/3+/$(H_2O)_6$ → Ru/sup 2+/3+/$(NH_3)_6$ is analyzed in terms of ligand-to-metal charge transfer (LMCT), and the trend is attributed to diminished participation of the metal atom in the redox process. The electronic rearrangement upon reduction is dominated by the e/sub g/(σ) manifold, even though the reducing electron is added to the t/sub 2g/(π) manifold.

26305 (CONF-8403124—Pt.1, pp 359-368) **Use of scaled orbital functions in self-consistent field calculations for atoms.** Liberman, D.A. (Los Alamos National Lab., NM). 1984. NTIS, PC A99/MF A01. File Number DE85009401.

From Sanibel symposia; Palm Coast, FL, USA (1 Mar 1984).

If a set of orbital functions phi/sub i/(r) is an approximate solution to the self-consistent field equations for an atom, the scaled orbital functions psi/sub i/(r) = λ/sub i//sup 3/2/phi/sub i/(λ/sub i/r will be a better solution if the scale parameters λ/sub i/ are properly chosen. The best choice of the scale parameters is determined by the variational principle. Two applications of this idea are made in this paper: one is an improved iteration scheme for solving the self-consistent field equations; the other is the calculation of the effects of relaxation when an electron is moved from one shell of an atom to another or is removed from the atom. In the first application the number of iterations required to converge the self-consistent field process is reduced by about two-thirds over the usual methods. In the second application, a sample calculation for argon shows the relaxation energies on ionization being calculated to within 0.5 eV.

26306 **(CONF-8404190—) Inelastic near-surface interactions. Proceedings of the Werner Brandt workshop.** (Oak Ridge National Lab., TN (USA)). Apr 1985. Contract AC05-84OR21400. 428p. NTIS, PC A19/MF A01; 1; GPO Dep. File Number DE85010579.

From Werner-Brandt workshop on penetration phenomena: inelastic near-surface interactions; Oak Ridge, TN, USA (12 Apr 1984).

This workshop is one of an annual series covering penetration phenomena of charged particles in matter. This specific workshop includes electron scattering, ion and atom scattering, stopping powers, and cluster ion impacts on solids. Abstracts were prepared for individual items in the proceedings for inclusion in the data base. (GHT)

26307 **(DOE/ER/10748—5) Many-body processes in atomic and molecular physics. Progress report, September 1, 1984-August 31, 1985.** Chu, S.I. (Kansas Univ., Lawrence (USA). Dept. of Chemistry). Apr 1985. Contract AC02-80ER10748. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85009750.

This program is directed towards the development of new theoretical formalisms and practical computational methods for ab initio investigation of the structure and quantum dynamics of atoms and molecules in intense fields. Major accomplishments over the past year are summarized.

26308 **(DOE/ER/12080—T1) Electron-atom collision studies using optically state selected beams. Progress report, 1 May 1984-30 April 1985.** Celotta, R.J.; Kelley, M.H. (National Bureau of Standards, Washington, DC (USA). Radiation Physics Div.). 1 Jan 1985. Contract AT01-82ER12080. 43p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85010848.

This report discusses the progress made on the research program on collision studies using optically state selected beams. The objective of this work is to stimulate deeper theoretical understanding of the electron-atom interaction by providing more complete experimental measurements on colliding systems. In particular we concentrate on effects dependent on the electron and atomic spins. Recent years have seen a rapid growth in the number and complex-

ity of experiments which include spin analysis. The additional information provided by such experiments has contributed greatly to our ability to model numerically collisions between electrons and atoms. Those measurements have typically been on systems where one of the incident particles has zero spin. Hence, one could derive no direct information about the exchange interaction. In our measurement, both collision partners have non zero spin so that we see directly the effects of the exchange as well as the spin-orbit interaction. Indeed, our experimental observable, the asymmetry in a scattering rate when the incident spins are parallel versus antiparallel, is directly related to the ratio of the collision cross sections for scattering via the triplet versus the singlet spin state. 19 refs., 12 figs.

26309 (INIS-mf—9483) Annual report 1983 of the section 'Karl Schoenherrstr. 3' (formerly 'Institute of Atomic Physics') of the 'Institute of Experimentalphysics' at the Leopold Franzens University, Innsbruck, Austria. Howorka, F.; Maerk, T.D.; Lindinger, W. (Innsbruck Univ. (Austria)). 1983. 35p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85700614.

The research topics in the institute were 1) State selected ion neutral interactions. 2) Vibrational temperature of ions. 3) Interstellar molecular synthesis. 4) Radiation damage in solids. 5) Excitation in ion-molecule and ion-atom collisions. 6) Hollow-cathode discharges.

26310 (LA—10227-C-Vol.2) Proceedings of the 1984 workshop on high-energy excitations in condensed matter. Volume II. Silver, R.N. (comp.). (Los Alamos National Lab., NM (USA)). Dec 1984. Contract W-7405-ENG-36. 348p. (CONF-840264—Vol.2). NTIS, PC A15/MF A01; 1; GPO Dep. File Number DE85007395.

From Workshop on high energy excitations in condensed matter; Los Alamos, NM, USA (13 Feb 1984).

This volume covers electronic excitations, momentum distributions, high energy photons, and a wrap-up session. Abstracts of individual items from the conference were prepared separately for the data base. (GHT)

26311 (LA-UR—85-1452) Excitation of some alkaline earth-like ions. Mann, J.B. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 6p. (CONF-8503127—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010737.

From Atomic data workshop; Daresbury, UK (29 Mar 1985).

Distorted wave excitation calculations were performed for seven spin-forbidden transitions in Al II. Collision strengths were calculated for three transitions for the beryllium-like C III ion, and bound wavefunctions were generated. Collision strengths were also calculated for the oxygen V ion. (DLC)

26312 (LBL—19215) Angle-resolved photoemission extended fine structure. Barton, J.J. (Lawrence Berkeley Lab., CA (USA)). Mar 1985. Contract AC03-76SF00098. 423p. NTIS, PC A18/MF A01; GPO Dep. File Number DE85010980.

Thesis.

Measurements of the Angle-Resolved Photoemission Extended Fine Structure (ARPEFS) from the S(1s) core level of a c(2 x 2)S/Ni(001) are analyzed to determine the spacing between the S overlayer and the first and second Ni layers. ARPEFS is a type of photoelectron diffraction measurement in which the photoelectron kinetic energy is swept typically from 100 to 600 eV. By using this wide range of intermediate energies we add high precision and theoretical simplification to the advantages of the photoelectron diffraction technique for determining surface structures. We report developments in the theory of photoelectron scattering in the intermediate energy range, measurement of the experimental photoemission spectra, their reduction to ARPEFS, and the surface structure determination from the ARPEFS by combined Fourier and multiple-scattering analyses. 202 refs., 67 figs., 2 tabs.

26313 Lifetime of the fluorescent excited state in solid, liquid, and vapor phase cyclohexane. Wickramaaratchi, M.A.; Preses, J.M.; Holroyd, R.A.; Weston R.E. Jr. (Chemistry Department, Brookhaven National Laboratory, Upton, New York 11973). *Journal of Chemical Physics;* **82**: No. 11, 4745-4752(1 Jun 1985).

The fluorescence lifetimes of cyclohexane in the solid, liquid, and vapor phase were measured using VUV synchrotron radiation from the National Synchrotron Light Source at BNL. The lifetime of liquid and solid cyclohexane changes with temperature, and the decay rate is a combination of a temperature-dependent Arrhenius-type process and a temperature-independent process. The results for liquid and solid cyclohexane from 59 to -49 °C can be represented by the expression $1/tau = [5.3 \times 10^{8} + 4.2 \times 10^{12} \exp(-5100/1.987\ T)]\ s^{-1}$. The latest lifetime measurements available in the literature for cyclohexane are in good agreement with our values measured between 20 and 25 °C. The lifetime of liquid cyclohexane at a given temperature is independent of the excitation energy. However, in the vapor phase the lifetime strongly depends on the excitation energy.

26314 Electron photodetachment from transient negative ions in the multiphoton ionization of CH_3I. Chupka, W.A.; Woodard, A.M.; Colson, S.D.; White, M.G. (Sterling Chemistry Laboratory, Yale University, New Haven, Connecticut 06511). *Journal of Chemical Physics;* **82**: No. 11, 4880-4885(1 Jun 1985). Contract AC02-76CH00016.

Photoelectron spectra produced by the laser multiphoton ionization of CH_3I show a strong band due to absorption of an additional photon above the ionization threshold and resembling either inverse bremsstrahlung or "above threshold ionization." The spectra are ascribed to a process of capture of Coulomb-retarded photoelectrons to form transient CH_3I^- ions which are then photodetached before, during and after dissociation to $CH_3 + I^-$ products. Both CH^-_3 and I^- ions are observed. Several aspects of the process are discussed in terms of a potential energy diagram.

26315 CASSCF-wave packet ab initio prediction of electronic and vibrational spectra: Application to the $A(^2\Pi) \leftarrow X(^2\Sigma^+)$ absorption of C_2H at 3000 K. Reimers, J.R.; Wilson, K.R.; Heller, E.J.; Langhoff, S.R. (Department of Chemistry, University of California, San Diego, La Jolla, California 92093). *Journal of Chemical Physics;* **82**: No. 11, 5064-5077(1 Jun 1985).

The combination of ab initio calculation of electronic wave functions with a wave packet calculation of the nuclear motion is used, within the Born—Oppenheimer approximation to compute the vibrational and electronic absorption of a polyatomic molecule. A particular virtue of this approach is that high as well as low temperature spectra are both calculable. This method is applied to C_2H, for which the complete active space self-consistent field (CASSCF) method is used to determine full Born—Oppenheimer potential surfaces. Using the assumption that the $A(^2\Pi) \leftarrow X(^2\Sigma^+)$ absorption can be written as the sum of the $A(^2A') \leftarrow X$ and $A(^2A'') \leftarrow X$ absorptions, the spectra are determined to 60 cm^{-1} resolution at a temperature of 3000 K. As a result of the large thermal bending amplitude at 3000 K, the calculated spectra are broad and have little resolved structure. Two bands are resolvable, one is due to the $A(^2A'') \leftarrow X$ absorption and is centered at 5500 cm^{-1}, while the other is due to $A(^2A') \leftarrow X$ absorption and is centered at 9500 cm^{-1}. The dramatic blue shift of the $A(^2A') \leftarrow X$ band results from the combination of the large X state thermal bending amplitude and high bending frequency of the $A(^2A')$ state. We also determine the X state pure vibrational absorption spectrum and show it to be of much lower intensity than the pure electronic spectrum.

26316 Ground-state properties of Be_2: A pseudopotential local-density approach. Richardson, S.L.; Chou, M.Y.; Cohen, M.L. (Department of Physics, University of California, Berkeley, California 94720 and Materials and Molecular Research Division, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Physical Review* [*Section*] *A: General Physics;* **31**: No. 5, 3444-3446(May 1985).

We present a pseudopotential local-density calculation for Be_2 using a molecular supercell scheme. The results for the binding

energy (-0.43 eV), equilibrium bond length (4.53 a.u.), and ground-state vibrational frequency (373 cm^{-1}) are in reasonable agreement with recent measurements and other quantum-chemical calculations.

26317 Equilibrium charge-state fractions of Li^-, Li^0, and Li^+ in Mg, Sr, and Cs vapors. Mowat, J.R.; Fisch, E.E.; Schlachter, A.S.; Stearns, J.W.; Bae, Y.K. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Physical Review [Section] A: General Physics;* **31**: No. 5, 2893-2897(May 1985). Contract AC03-76SF00098.

Li^+ ions, accelerated to energies between 1 and 20 keV, pass through thick vapor targets of Mg, Sr, and Cs. The ions that emerge into a narrow, forward-directed cone are electrostatically separated into three charge-state components: Li^-, Li^0, and Li^+. The principal results over this energy range are the following: (1) The negative fraction peaks at 5% near 5 keV for a Cs target, and is less than 1% in Mg and Sr targets; (2) for Sr and Cs targets, the beam is greater than 90% neutral; and (3) for a Mg target, the beam does not neutralize at the lowest energies studied, remaining mostly positive between 1 and 10 keV.

26318 Anisotropic scattering of electrons by N_2 and its effect on electron transport. Phelps, A.V.; Pitchford, L.C. (Joint Institute for Laboratory Astrophysics, National Bureau of Standards and University of Colorado, Boulder, Colorado 80309). *Physical Review [Section] A: General Physics;* **31**: No. 5, 2932-2949(May 1985).

As part of a systematic study of approximations commonly made in solutions of the Boltzmann equation for electrons in molecular gases, we have investigated the effects of anisotropic scattering on electron transport coefficients in N_2 and have extended our study of the multiterm expansion technique to higher E/n. A critical survey of published data yields a set of differential and integral cross sections for electron energies from 0.003 to 10^4 eV. For electric-field—to—gas-density ratios E/n between 10 and 500 Td (1 Td = 10^{-21} V m^2), the changes in the commonly measured transport and reaction coefficients resulting from the introduction of anisotropic elastic and inelastic scattering, while keeping the elastic momentum-transfer cross section constant, are less than 1%.

26319 Molecular resonance phenomena. Hazi, A.U. (Lawrence Livermore National Lab., CA). pp 103-119 of Electron-atom and electron-molecule collisions. Hinze, J. (ed.). New York, NY; Plenum Publishing Corporation (1983).

The Stieltjes-moment-theory technique is reviewed and its application to resonance phenomena in diatomic molecules is examined. It is shown that the method yields reasonably accurate results and possesses a number of advantages for molecular applications.

26320 Recent developments in complex scaling. Rescigno, T.N. (Lawrence Livermore National Lab., CA). pp 51-72 of Electron-atom and electron-molecule collisions. Hinze, J. (ed.). New York, NY; Plenum Publishing Corporation (1983). Contract W-7405-ENG-48.

Recent developments in the use of complex basis function techniques to study resonance, as well as certain types of non-resonant, scattering phenomena are discussed. Areas discussed include partial widths, complex-coordinate procedures, and complex SCF techniques.

26321 Charge asymmetry dependence of x-ray transitions into the $2p\sigma$ quasimolecular orbital emitted in slow heavy ion collisions. Stockli, M.P. (Kansas State Univ., Manhattan). pp 1033-1046 of Spectral line shapes. Volume 2. Berlin, Germany, F.R.; Walter de Gruyter & Company (1983). Contract AC02-76ER02753.

In heavy ion collisions the inner shell electrons will adjust to the changing potential of the two colliding nuclei, if the collision is considerably slower than the incident electrons, (v/sub c/v/sub el/ < 0.3). The model of transcient molecular orbitals formed during the collisions has been very successful in describing the experimental phenomena. However, in most applications, including ionization, vacancy sharing and charge transfer, the experiments compare only the initial and final states with the model's predictions. The study of x-rays emitted during the collisions allows a real test of the transient molecular orbitals (MO). In this work it is shown that the $2p\sigma$ MO-spectra agree with the properties one expects using simple models. Specifically, it is shown that a satellite structure due to the $2p\sigma$ minimum is observed only at low velocities. There is strong evidence that the $2p\sigma$ minimum binding energy which depends strongly on the charge asymmetry is in agreement with the calculation of Eichler and Wille et al. It is also shown that the collision broadening depends strongly on the charge asymmetry and can be explained by adapting the theory of the $ls\sigma$ MO-collision broadening. 12 references, 7 figures.

26322 Factorization of scattering information in molecular collision theory. Chan, C.K. Ames, IA; Iowa State Univ. (1983). 239p. University Microfilms Order No. 83-23,270.Contract W-7405-ENG-82.

Thesis (Ph. D.).

In several important approximate treatments in molecular collision theory, the S- and T-matrices are local in some subset of coordinates. Linear factorization relations and consistency conditions are derived for the matrix elements of such local operator and sometimes for the appropriately averaged square of the magnitude of these matrix elements. The coefficients in these relations and conditions are spectroscopic (i.e., dynamics independent). Using these relations, one can predict scattering information (S/T-matrices and degeneracy averaged cross sections) for any transition using corresponding information for transitions out of (or into) a fixed, but arbitrary, input state. The relevance of these relations to various forms as of the sudden approximation is explored. Factorization in the sudden approximation of atom-diatom phenomeno-logical cross sections, which are important in transport coefficient calculations, is also examined. Finally, the energy sudden (ES) factorization relations for the T-matrix elements in a dissociative collision are studied. The theory is applied to collinear collisions between an atom and a truncated square well, diatomic oscillator. Under certain conditions, vibrational enhancement/inhibition as a function of the final dissociative state can be predicted without any dynamic calculation of the transition probabilities. Some results of calculations are discussed.

6404 Fluid Physics

REFER ALSO TO CITATION(S) 26453

26323 (LA-UR—85-1078) Compressible Lagrangian hydrodynamics without Lagrangian cells. Clark, R.A. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 15p. (CONF-8503130—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85009597.

From Science Applications international conference on free-langrangian methods; Annapolis, MD, USA (1 Mar 1985).

The formulation normally used to calculate compressible Lagrangian hydrodynamics in two dimensions is the following. First define a two-dimensional mesh containing a set of Lagrangian cells. Assign each cell a fixed mass. Compute the acceleration of the mesh points and move the points. The volume of the cell changes with the motion of the points. The changes in cell density, energy, and pressure are computed from the changes in volume. Difficulties occur when there are large distortions in the flow that cause similar large distortions in the Lagrangian cells. The usual solution is to somehow adjust the mesh as the calculation proceeds. This involves either moving individual mesh points or actually reconnecting the mesh. In either case, it becomes necessary to remap the mass from the old cells to the new. This necessarily produces some amount of undesirable numerical diffusion. When and how to adjust the mesh and how to accurately remap the mass and other variables so as to minimize numerical diffusion are the problems. One way to eliminate these problems is to abandon the idea of the Lagrangian cell since it is the distortion of the Lagrangian cell that is the cause of all the other problems. We discuss how the conservation equations can be solved directly without resorting to Lagrangian cells, and we give some examples of calculations using this method. Finally, we give details of the calculational method presently being used.

26324 (UCRL—91824-Rev.1) Highly accurate shock flow calculations with moving grids and mesh refinements. Revision 1. Kansa, E.J. (Lawrence Livermore National Lab., CA (USA)). Apr 1985. Contract W-7405-ENG-48. 5p. (CONF-850861—1-Rev.1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010929.

From 11. International Association of Mathematics and Computers Simulation world congress; Oslo, Norway (5 Aug 1985).

Five one-dimensional (1D) and one 2D shock wave problems which propagate obliquely to the coordinate axes are solved by a second-order time-marching method. The solution region is assumed to be piecewise continuous, with any discontinuities which may develop being represented by an arctan approximation to a step function. Immediately behind or ahead of a flagged discontinuity, appropriate one-sided derivatives are used. An explicit moving grid technique is combined with the time-integration scheme which yields the correct velocity at discontinuities. Shock fitting is not only simply handled, but it is handled automatically and correctly by the choice of the grid velocities. The regularization problem associated with moving grids is handled by a rezoning based on equidistributing the component averaged third derivative. Because the approximate step-function and above-mentioned rules for derivative formation are mathematically consistent, artificial viscosity is unnecessary. The same second-order time integration scheme is used throughout the entire spatial domain. 12 refs., 9 figs.

26325 Nonuniform fluids in the grand canonical ensemble. Percus, J.K. (New York Univ., New York). *International Journal of Quantum Chemistry, Symposium;* No. 16, 33-48(1982). (CONF-820330—). Contract AC02-76ER03077.

From International symposium on quantum chemistry, theory of condensed matter, and propagator methods in the quantum theory of matter; Flagler Beach, FL, USA (1 Mar 1982).

Nonuniform simple classical fluids are considered quite generally. The grand canonical ensemble is particularly suitable, conceptually, in the leading approximation of local thermodynamics, which figuratively divides the system into approximately uniform spatial subsystems. The procedure is reviewed by which this approach is systematically corrected for slowly varying density profiles, and a model is suggested that carries the correction into the domain of local fluctuations. The latter is assessed for substrate bounded fluids, as well as for two-phase interfaces. The peculiarities of the grand ensemble in a two-phase region stem from the inherent very large number fluctuations. A primitive model shows how these are quenched in the canonical ensemble. This is taken advantage of by applying the Kac-Siegert representation of the van der Waals decomposition with petit canonical corrections, to the two-phase regime.

6450 High Energy Physics

26326 (DOE/ER/40158—1) Theory of high energy collision processes. Technical progress report, January 1, 1984-December 31, 1984. Wu, T.T. (Harvard Univ., Cambridge, MA (USA). Div. of Applied Sciences). 22 Jan 1985. Contract FG02-84ER40158. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010183.

Progress is briefly described on the following topics: CERN p anti p total cross sections and elastic differential cross sections, theory of hadronic scattering at very high energies, studies of the magnetic monopole and the dyon, two- and three-dimensional exactly solvable models in statistical mechanics, quantum field theory in 4 + n dimensions, neutrino counting at the Z^0 peak, generalization of procedure used in the asymptotic investigation of the quasi-Abelian model of quark and anti-quark sources, the method of helicity amplitudes, the use of Pontryagin spaces for studies in higher dimensions, and a study indicating that large-distance dependence of the form (l/r) does not necessarily hold for time-dependent problems. Publications are listed. (WHK)

6451 Particle Interactions And Properties - Experimental

REFER ALSO TO CITATION(S) 25976, 26347, 26368

26327 (FNAL/C—85/36) Fixed-target physics at Fermilab. Bjorken, J.D. (Fermi National Accelerator Lab., Batavia, IL (USA)). Mar 1985. Contract AC02-76CH03000. 16p. (CONF-8410222—20). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010141.

From American Physical Society meeting; Santa Fe, NM, USA (31 Oct 1984).

The Fermilab Energy Saver is now successfully commissioned and fixed-target experimentation at high energy (800 GeV) has begun. In addition, a number of new experiments designed to exploit the unique features of the Tevatron are yet to come on-line. In this talk, we will review recent accomplishments in the fixed-target program and describe experiments in progress and others yet to come.

26328 (ZfK—528) Target mass number dependence of cluster excitation in hadron-nucleus collisions. Komarov, V.I.; Mueller, H.; Tesch, S. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Jun 1984. 18p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700575.

A phenomenological cluster excitation model is used to calculate spectra of backward emitted protons and pions from proton- and pion-nucleus collisions at incidence energies of 1 GeV to 400 GeV. Assuming the same properties of clusters within all target nuclei good agreement of the model calculations with experimental data is reached for a wide region of the target mass number.

26329 Direct measurement of charmed D^+ and D^0 semileptonic branching ratios. Baltrusaitis, R.M.; Becker, J.J.; Blaylock, G.T.; Brown, J.S.; Bunnell, K.O.; Burnett, T.H.; Cassell, R.E.; Coffman, D.; Cook, V.; Coward, D.H.; Dado, S.; Del Papa, C.; Dorfan, D.E.; Dubois, G.P.; Duncan, A.L.; Einsweiler, K.F.; Eisenstein, B.I.; Fabrizio, R.; Gladding, G.; Grancagnolo, F.; Hamilton, R.P.; Hauser, J.; Heusch, C.A.; Hitlin, D.G.; Koepke, L.; Lockman, W.S.; Mockett, P.M.; Moss, L.; Mozley, R.F.; Nappi, A.; Odian, A.; Partridge, R.; Perrier, J.; Plaetzer, S.A.; Richman, J.D.; Roehrig, J.R.; Russell, J.J.; Sadrozinski, H.F.W.; Scarlatella, M.; Schalk, T.L.; Schindler, R.H.; Seiden, A.; Sleeman, J.C.; Spadafora, A.L.; Thaler, J.J.; Toki, W.; Tripsas, B.; Villa, F.; Wattenberg, A.; Weinstein, A.J.; Wermes, N.; Willutzki, H.J.; Wisinski, D.E.; Wisniewski, W.J. (California Institute of Technology, Pasadena, California 91125; University of California at Santa Cruz, Santa Cruz, California 95064; University of Illinois at Urbana-Champaign, Urbana, Illinois 61801; Stanford Linear Accelerator Center, Stanford, California 94305; and University of Washington,). *Physical Review Letters;* 54: No. 18, 1976-1979(6 May 1985). Contract AC03-76SF00515;AC02-76ER01195;AC03-81ER40050;AM03-76SF00034.

Measurements of the semileptonic branching ratios of charmed D^+ and D^0 mesons are presented, from data collected at the psi(3770) in the Mark III detector at SPEAR. From a sample of events kinematically selected as charmed D^+D^- or D^0D^0 pairs, the branching ratios $R(D^+ \to e^+ + X) = (17.0 +- 1.9 +- 0.7)\%$ and $R(D^0 \to e^+ + X) = (7.5 +- 1.1 +- 0.4)\%$ are obtained. The ratio of these measurements can be interpreted as the ratio of D^+ and D^0 lifetimes tau$^+$/tau^0 = 2.3/sub -0.4-0.1/ /sub +0.5+0.1/ by neglect of the contribution of Cabibbo-suppressed decays to the total decay width.

26330 **New results on the reaction $e^+e^- \to \mu^+\mu^-$ at $\sqrt{s}$ = 29 GeV.** Derrick, M.; Fernandez, E.; Fries, R.; Hyman, L.; Kooijman, P.; Loos, J.S.; Musgrave, B.; Price, L.E.; Schlereth, J.; Sugano, K.; Weiss, J.M.; Wood, D.E.; Ahlen, S.; Baranko, G.; Baringer, P.; Blockus, D.; Brabson, B.; Daigo, M.; Forden, G.E.; Gray, S.W.; Guillaud, J.; Jung, C.; Neal, H.; Ogren, H.; Rust, D.R.; Valdata-Nappi, M.; Akerlof, C.; Chapman, J.; Errede, D.; Harnew, N.; Kesten, P.; Kooijman, S.; Meyer, D.I.; Nitz, D.; Rubin, D.; Seidl, A.A.; Thun, R.; Trinko, T.; Willutzky, M.; Beltrami, I.; DeBonte, R.; Gan, K.K.; Koltick, D.; Loeffler, F.J.; Mallik, U.; McIlwain, R.L.; Miller, D.H.; Ng, C.R.; Ong, P.P.; Rangan, L.K.; Shibata, E.I.; Stevens, R.; Wilson, R.J.; Cork, B.; Keller, L.; Va'vra, J. (Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review* [*Section*] *D: Particles and Fields;* **31**: No. 9, 2352-2355(1 May 1985).

We have measured the processe$^+e^- \to \mu^+\mu^-$ at $\sqrt{s}$ = 29 GeV using the High Resolution Spectrometer at SLAC PEP. The forward-backward charge asymmetry is A/sub mumu/ = -(4.9 +- 1.5 +- 0.5)% based on 5057 events. A subsample of 3488 $\mu^+\mu^-$ events in the angular range '$\cos\theta' < 0.55$ gives a cross-section ratio of R/sub mumu/ = 0.990 +- 0.017 +- 0.030. The resulting couplings of the weak neutral current are g/sub a//sup e/g/sub a//sup μ/ = 0.208 +- 0.064 +- 0.021 and g/sub v//sup e/g/sub v//sup μ/ = 0.027 +- 0.051 +- 0.089. The QED cutoff parameters are Λ/sub +/>170 GeV and Λ/sub -/>146 GeV at 95% C.L.

26331 **Excited Z^0 bosons and the anomalous CERN events.** Rizzo, T.G. (Ames Laboratory and Department of Physics, Iowa State University, Ames, Iowa 50011). *Physical Review* [*Section*] *D: Particles and Fields;* **31**: No. 9, 2369-2371(1 May 1985). Contract W-7405-ENG-82.

The observation of high-energy photons in association with the leptonic decay of the Z^0 by both the UA1 and UA2 Collaborations has led to discussions of composite gauge bosons. If the Z^0 is composite then excited Z^0 bosons could play a role in the virtual imtermediate state: $Z^0 \to Z$/sub virt/($+\gamma$, Z/sub virt/($\to l^+l^-$. We examine the predictions of a generic model of this kind for the decay rate, photon energy spectrum, and γl^{+-} opening-angle distribution. We find the prediction for the latter to be in disagreement with the CERN data while the photon energy spectrum is peaked at $\approx$30 GeV in agreement with the data.

26332 **Crystal ball evidence for new states.** Coyne, D.G. (Stanford Univ., CA). *AIP (American Institute of Physics) Conference Proceedings;* No. 81, 61-84(1982). (CONF-810986—). Contract AC03-76SF00515.

From Meeting of the division of particles and fields of the American Physical Society; Santa Cruz, CA, USA (9 Sep 1981).

Evidence for three new particles observed in the Crystal Ball detector is presented. The first particle, at 3592 MeV, is seen inclusively in γ transitions from psi', and is thus a candidate for eta/sub c/'. The other two, at 1440 and 1640 MeV, are best seen in exclusive decays of psi involving a prompt γ, and are thus candidates for bound states of two gluons. Detailed reasons are presented to support the contention that these states are distinct from previously observed candidates such as E(1420). Alternative hypotheses are discussed.

26333 **Baryon production at PEP.** Goldhaber, G.; Weiss, J.M. (Univ. of California, Berkeley). *AIP (American Institute of Physics) Conference Proceedings;* No. 81, 163-172(1982). (CONF-810986—). Contract AC03-76SF00515;W-7405-ENG-48.

From Meeting of the division of particles and fields of the American Physical Society; Santa Cruz, CA, USA (9 Sep 1981).

Measurements of inclusive Λ + anti Λ production for 1.0 $\leqq$ p $\leqq$ 10.0 GeV/c and p + anti p production for 0.4 $\leqq$ p $\leqq$ 2.0 GeV/c show significant baryon production in e^+e^- annihilation at E/sub c.m./ = 29 GeV. Λ + anti Λ production represents 0.2 Λ's or anti Λ's per PEP event while the observed p + anti p production implies all baryon-antibaryon pair production is occurring at least as often as 0.6 per event, depending on the yet to be measured p + anti p production at high momentum. Comparisons are made with the first theoretical attempts to account for baryon production at these energies.

26334 **Review of multimuon production by muons.** Strovink, M. (Univ. of California, Berkeley). *AIP (American Institute of Physics) Conference Proceedings;* No. 81, 199-226(1982). (CONF-810986—). Contract W-7405-ENG-48.

From Meeting of the division of particles and fields of the American Physical Society; Santa Cruz, CA, USA (9 Sep 1981).

Production of 2, 3, 4, and 5-muon final states by high-energy muons at Fermilab and CERN SPS is reviewed. Sixty-three 4μ, 5μ, and odd-sign 3μ final states have been observed. Corresponding limits on muoproduction of UPSILON, b anti b, and anti M^0 are summarized. Precise data on the Q^2 and nu-dependence of muo-produced elastic-psi, inelastic-psi, and open-charm states are presented. Elastic and inelastic psi muoproduction results are extended to include distributions in production and decay angle, elasticity, and momentum transfer to hadrons. Calculations using the lowest-order photon-gluon-fusion graph can be adjusted to reproduce the nu-dependence of elastic psi production, the nu and Q^2 dependence of open charm production, and the combined (hidden + open) charm production cross section. Unfortunately, the model does not account for the angular distributions and Q^2-dependence observed for elastic psi production.

26335 **Lepton spectrum.** Feldman, G.J. (Stanford Univ., CA). *AIP (American Institute of Physics) Conference Proceedings;* No. 81, 280-302(1982). (CONF-810986—). Contract AC03-76SF00515.

From Meeting of the division of particles and fields of the American Physical Society; Santa Cruz, CA, USA (9 Sep 1981).

Selected topics on the lepton spectrum are presented. Special emphasis is placed on tau decays and unpublished Mark II results from SPEAR and PEP.

26336 **NuN, μN interactions: structure functions, higher twist.** Matteuzzi, C. (Stanford Linear Accelerator Center, CA). *AIP (American Institute of Physics) Conference Proceedings;* No. 81, 186-198(1982). (CONF-810986—). Contract AC03-76SF00515.

From Meeting of the division of particles and fields of the American Physical Society; Santa Cruz, CA, USA (9 Sep 1981).

Data on deep inelastic scattering of leptons by nucleons and nuclei have been accumulated for several years. Results exist from several experiments with electron, muon, neutrino beams. This talk reviews the most recent experiments which measured nucleon structure functions with nu and μ beams. In particular, the results on R = σ/sub L//σ/sub T/ measurement, on $F_2(x, Q^2)$ and $xF_3(x, Q^2)$, and their interpretation in terms of QCD, including both gluon radiation and higher twist phenomena are summarized.

26337 **Baryon stability, a review of limits and experimental prospects.** Learned, J.G. (Univ. of Hawaii, Honolulu). *AIP (American Institute of Physics) Conference Proceedings;* No. 81, 461-479(1982). (CONF-810986—). Contract AM03-76SF00235.

From Meeting of the division of particles and fields of the American Physical Society; Santa Cruz, CA, USA (9 Sep 1981).

This paper reviews past and recent limits on the baryon decay lifetime and presents a preview of short- and long-range prospects for decay searches. Present limits for the standard model favored mode ($e^+\pi^0$) yield a baryon lifetime $\sim > 8 \times 10^{30}$ years. Theoretical predictions vary over the range 10^{31+-1} years. New searches in preparation will be capable of extending limits to 10^{32} years within about one year and to 10^{33} years after several years work. Branching ratios will soon be well-explored only if the lifetime is less than $\sim 10^{33}$ years. If the lifetime is $\sim < 10^{34}$ years, a deep ocean detector of 10^6 tons may be required to detect decays. If the lifetime $\sim > 10^{35}$ years, it seems unlikely to be experimentally observed any time in the foreseeable future. It is already apparent that a detector designed to study decay modes will have to be $\sim > 10^4$ tons in effective mass.

26338 **Lepton stability.** Cooper, M.C. (Los Alamos National Lab., NM). *AIP (American Institute of Physics) Conference Proceedings;* No. 81, 480-495(1982). (CONF-810986—).

From Meeting of the division of particles and fields of the American Physical Society; Santa Cruz, CA, USA (9 Sep 1981).

The problem of flavor-changing currents in the lepton sector is reviewed. The emphasis is on the experimental situation, with a brief discussion of the theoretical problems which are addressed by the measurements.

6452 Particle Interactions And Properties - Theoretical

REFER ALSO TO CITATION(S) 26331, 26351, 26351, 26359, 26415, 26415

26339 **(DOE/ER/10957—1) Research in the theory of condensed matter and elementary particles. Progress report.** (Chicago Univ., IL (USA)). 1981. Contract AC02-81ER10957. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010206.

Brief progress summaries are given on the dynamics of Polyakov's string, the problem of putting chiral fermions on the lattice, order and disorder that arises in two-dimensional systems with incommensurate phases, gauge theory in 1 + 1 dimension with quarks being treated as classical particles, the finite temperature deconfining transition in the 2 + 1 dimension compact U(1) lattice gauge theory (the Polyakov model), the Monte Carlo renormalization group treatment of the O(3) nonlinear σ model, Yang-Mills-Higgs system in 2 + 1 dim., large N expansion for biquadratic spin systems, and variational method for quenched Parisi model. Publications are listed. 27 refs. (WHK)

26340 **Fermions interacting with spherically symmetric monopoles: Beyond the step-function approximation.** Rao, S. (Fermi National Accelerator Laboratory, P.O. Box 500, Batavia, Illinois 60510). *Physical Review [Section] D: Particles and Fields;* **31**: No. 10, 2559-2566(15 May 1985).

We analyze the interactions of massless fermions in arbitrary representations of the gauge group, with general spherically symmetric monopoles of arbitrary strength. We obtain the conditions for finiteness of the solutions to the Dirac equation at the origin, evolve it through arbitrary radial functions, and obtain the boundary conditions at the monopole-core radius, thus improving upon the step-function approximation previously used. We show that our results differ from the results using the step-function approximation only when the boundary conditions are not diagonalizable on the physical basis, and hence processes involving such cases may be used to probe the structure of the monopole core.

26341 **Fractional charges for the non-Abelian fermion-monopole system.** Panagopoulos, H. (Laboratoire de Physique Nucleaire, Universite de Montreal, Montreal, Quebec, Canada H3C3J7). *Physical Review [Section] D: Particles and Fields;* **31**: No. 10, 2567-2574(15 May 1985). Contract AC02-76ER03069.

The Dirac equation is studied in the background of a non-Abelian magnetic monopole. The inclusion of chirally rotated scalar and isotriplet masses induces a dependence of the charge and fermion number densities on the chiral angles. These densities, and the associated total charges, are computed in the limit of infinite monopole mass, and compared to the results for the Abelian monopole. Choosing an appropriate self-adjoint extension, non-Abelian fermion-monopole systems can always be modeled by Abelian ones.

26342 **Factorization of the Drell-Yan cross section in perturbation theory.** Bodwin, G.T. (High Energy Physics Division, Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review [Section] D: Particles and Fields;* **31**: No. 10, 2616-2642(15 May 1985). Contract W-31-109-ENG-38.

We develop, through detailed one- and two-loop examples, a procedure for expressing the leading-twist Drell-Yan cross section in terms of the factored form proposed by Collins, Soper, and Sterman. We then show that this factorization program can be implemented to all orders in perturbation theory. The factored cross section takes the form of an on-shell qq-bar annihilation cross section (less certain collinear subtractions) convolved with structure functions for the incoming hadrons. The structure functions contain all the collinear singularities and spectator interactions. They are shown to be simply related to those that occur in deep-inelastic lepton scattering. We also demonstrate that the qq-bar cross section minus the collinear subtractions is free of infrared singularities if one integrates over the transverse momentum of the lepton pair.

26343 **Radiative decay of heavy Higgs bosons.** Rizzo, T.G. (Ames Laboratory and Department of Physics, Iowa State University, Ames, Iowa 50011). *Physical Review [Section] D: Particles and Fields;* **31**: No. 9, 2366-2368(1 May 1985). Contract W-7405-ENG-82.

The decays of heavy Higgs bosons (m/sub H/> or $\approx$200 GeV) are dominated by W^+W^- and Z^0Z^0 final states. We examine the related radiative decay $H \rightarrow W^+W^-\gamma$ for hard photons, which has a fairly large relative branching ratio (20—40%) as the Higgs-boson mass increases. This process further enlarges the width-to-mass ratio of the heavy Higgs boson, signaling a breakdown in perturbation theory as the Higgs-boson mass nears 1 TeV.

26344 **Hadron-hadron interaction in a string-flip model of quark confinement. I. Meson-meson interaction.** Oka, M. (Center for Theoretical Physics, Laboratory for Nuclear Science and Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Physical Review [Section] D: Particles and Fields;* **31**: No. 9, 2274-2287(1 May 1985). Contract AC02-76ER03069.

The string-flip model of quark confinement is extended and applied to q^3q-bar ^{3} systems with color, spin, and flavor degrees of freedom. A realistic model for systems of two light mesons is constructed and the meson-meson interaction is investigated with the resonating-group method. Choosing the confinement strength for the confined ("hidden-color") state is discussed in detail. We find that the interaction in the confined state often produces two-meson bound states or low-lying sharp resonances. The 2^+ two-vector-meson systems and the K-K-bar interaction are studied in detail. The results are compared with those for other models and the possibility of observing "hidden-color" dominant resonances is discussed.

26345 **Vector-meson mass generation by chiral anomalies.** Jackiw, R.; Rajaraman, R. (Center for Theoretical Physics and Laboratory for Nuclear Science, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Physical Review Letters;* **54**: No. 12, 1219-1221(25 Mar 1985). Contract AC02-76ER03069.

We show that the chiral Schwinger model, which is anomalous, yields a consistent and unitary, although not gauge-invariant, theory. The model is exactly solvable and contains a free massive vector boson plus harmonic excitations.

26346 **Status of the top-quark.** Hill, C.T. (Fermi National Accelerator Lab., Batavia, IL). *AIP (American Institute of Physics) Conference Proceedings;* No. 81, 303-311(1982). (CONF-810986—).

From Meeting of the division of particles and fields of the American Physical Society; Santa Cruz, CA, USA (9 Sep 1981).

A brief review of current predictions and bounds on the mass of the t-quark is presented. Most involve new ideas based on Grand Unification.

26347 **Glueball and exotic meson candidates.** Chanowitz, M.S. (Lawrence Berkeley Lab., CA). *AIP (American Institute of Physics) Conference Proceedings;* No. 81, 85-96(1982). (CONF-810986—). Contract W-7405-ENG-48.

From Meeting of the division of particles and fields of the American Physical Society; Santa Cruz, CA, USA (9 Sep 1981).

The states seen in radiative psi decay at 1440 and 1640 MeV are discussed. It is argued that the former is almost certainly a glueball while the latter is probably either a glueball or a four quark anti ss (anti uu + anti dd) state. The present status and future verification of these assignments is discussed.

26348 **Monte Carlo studies of quark-gluon dynamics.** Creutz, M. (Brookhaven National Lab., Upton, NY). *AIP (American Institute of Physics) Conference Proceedings;* No. 81, 238-244(1982). (CONF-810986—). Contract AC02-76CH00016.

From Meeting of the division of particles and fields of the American Physical Society; Santa Cruz, CA, USA (9 Sep 1981).

Because of the analogy between the Feynmann path integral and a partition function, Monte Carlo simulation of statistical systems has recently become a powerful tool of the elementary particle theorist. This numerical method for the evaluation of path integrals is generally studied with a space time lattice providing an ultraviolet cut-off. The technique converges well in both strong and weak coupling regimes and interpolates nicely in between. Furthermore, as entire field configurations are stored in the computer memory, any desired correlation function is in principle available. Recent progress in understanding strong interaction physics through Monte Carlo simulation of lattice gauge theory is reviewed.

6453 Particle Invariance Principles And Symmetries

REFER ALSO TO CITATION(S) 26356

26349 Spontaneous gauge-symmetry breaking in higher-dimensional theories. Lim, C.S. (Physics Department, Brookhaven National Laboratory, Upton, New York 11973). *Physical Review [Section] D: Particles and Fields;* **31**: No. 10, 2507-2513(15 May 1985). Contract AC02-76CH00016.

We investigate spontaneous breaking of gauge symmetries, isometry groups of extra spaces, in (4+N)-dimensional general relativities. The symmetry breaking SO(N+1)→SO(N) is discussed, as a simple example. The problem reduces to a study of the effective potential's stability against deformation of the extra space, S/sup N/→M/sub el//sup N/, M/sub el//sup N/ being an N-dimensional "elliptic" manifold. Taking into account quantum effects of scalar fields on the effective potential, we show that such gauge symmetry breaking is possible, but only for N = 5.

26350 Induced Chern-Simons terms at high temperatures and finite densities. Redlich, A.N.; Wijewardhana, L.C.R. (Center for Theoretical Physics, Laboratory for Nuclear Science, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Physical Review Letters;* **54**: No. 10, 970-973(11 Mar 1985). Contract AC02-76ER03069;AC02-76ER03075.

The CP nonconserving portion of the gauge-field effective action for an even number of left-handed SU(2) fermion doublets, with nonzero chemical potentials μ_i, is calculated to leading order in the inverse temperature, T^{-1}. It is shown to be i summation/sub i/ (μ_i^3/T)W[A], where W[A] is the Chern-Simons topological mass term. This result is also shown to be a consequence of the U(1)/sub L/ anomaly at zero temperature, but with $\mu_i$not =0. Because of the i in front of the Chern-Simons term, this produces magnetic screening only if μ_i is complex.

6454 Field Theory

REFER ALSO TO CITATION(S) 26258, 26342, 26344, 26345, 26348, 26349, 26350

26351 (BNL—36147) Standard model and beyond. Marciano, W.J. (Brookhaven National Lab., Upton, NY (USA)). 1985. Contract AC02-76CH00016. 30p. (CONF-850146—5). NTIS, PC A03/MF A01; GPO Dep. File Number DE85010239.

From Aspen winter physics conference; Aspen, CO, USA (14 Jan 1985).

The "standard" SU(3)/sub C/ x SU(2)/sub L/ x U(1) model of strong and electroweak interactions elegantly incorporates all the proven symmetries and successes of the quark model, quantum electrodynamics, and the Four-Fermi theory. It correctly predicted weak neutral currents as well as the existence and properties of W^{+-}, Z and gluons. "Only" the predicted Higgs scalar boson remains undiscovered. At this time there are no solid experimental results that cannot be accommodated by the standard model (at the 1 or 2 sigma level). Nevertheless, we do anticipate the emergence of new physics, beyond standard model expectations, which will hopefully provide guidance for theoretical advancement. Indeed, hints of some new phenomena may already be starting to appear in the CERN anti pp collider data. Details are discussed. 65 refs.

26352 (LA-UR—85-1317) Monte Carlo sampling strategies for lattice gauge calculations. Guralnik, G.; Zemach, C.; Warnock, T. (Los Alamos National Lab., NM (USA); Cray Research, Inc., Los Alamos, NM (USA)). 1985. Contract W-7405-ENG-36. 14p. (CONF-8504110—10). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010756.

From Joint Los Alamos/CEA meeting on Monte Carlo methods; Cadarache, France (22 Apr 1985).

We have sought to optimize the elements of the Monte Carlo processes for thermalizing and decorrelating sequences of lattice gauge configurations and for this purpose, to develop computational and theoretical diagnostics to compare alternative techniques. These have been applied to speed up generations of random matrices, compare heat bath and Metropolis stepping methods, and to study autocorrelations of sequences in terms of the classical moment problem. The efficient use of statistically correlated lattice data is an optimization problem depending on the relation between computer times to generate lattice sequences of sufficiently small correlation and times to analyze them. We can solve this problem with the aid of a representation of auto-correlation data for various step lags as moments of positive definite distributions, using methods known for the moment problem to put bounds on statistical variances, in place of estimating the variances by too-lengthy computer runs.

26353 Quantized electric-flux-tube solutions to Yang-Mills theory. Baker, M.; Ball, J.S.; Zachariasen, F. (Department of Physics, FM-15, University of Washington, Seattle, Washington 98195). *Physical Review [Section] D: Particles and Fields;* **31**: No. 10, 2575-2588(15 May 1985). Contract AC03-81ER40050.

We suggest that long-distance Yang-Mills theory is more conveniently described in terms of electric rather than the customary magnetic vector potentials. On this basis we propose as an effective Lagrangian for this regime the most simple gauge-invariant (under the magnetic rather than electric gauge group) and Lorentz-invariant Lagrangian which yields a $1/q^4$ gluon propagator in the Abelian limit. The resulting classical equations of motion have solutions corresponding to tubes of color electric flux quantized in units of e/2 (e is the Yang-Mills coupling constant). To exponential accuracy the electric color energy is contained in a cylinder of finite radius, showing that continuum Yang-Mills theory has excitations which are confined tubes of color electric flux. This is the criterion for electric confinement of color.

26354 T expansion and SU(2) lattice gauge theory. Horn, D.; Karliner, M.; Weinstein, M. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305). *Physical Review [Section] D: Particles and Fields;* **31**: No. 10, 2589-2599(15 May 1985). Contract AC03-76SF00515.

This paper presents the results obtained by applying the t expansion to the case of an SU(2) lattice gauge theory in 3+1 space-time dimensions. We compute the vacuum energy density, specific heat, string tension σ, mass M of the lowest-lying 0^{++} glueball, and the ratio $R = M^2/\sigma$. Our computations converge best for the energy density, specific heat, and R, and these quantities exhibit behavior which agrees with what we expect on general grounds and what is known from Euclidean Monte Carlo calculations. In particular we see a broad lump in the specific heat and determine $\sqrt{R}$ to be $\sqrt{R} = 3.5 +- 0.2$, a value which lies in the ballpark of values obtained from Monte Carlo calculations. Our direct computations of the mass of the 0^{++} glueball and string tension cannot be easily compared to the results of Monte Carlo calculations, but appear to be consistent with what one would expect.

26355 Static solutions in the vacuum sector of the Skyrme model. Bagger, J.; Goldstein, W.; Soldate, M. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305). *Physical Review [Section] D: Particles and Fields;* **31**: No. 10, 2600-2604(15 May 1985). Contract AC03-76SF00515.

We use topological methods to prove the existence of a nontrivial static solution in the vacuum sector of the gauged Skyrme model. We then search for a purely strong-interaction saddle point by computing the interaction energy of a Skyrmion—anti-Skyrmion pair.

26356 **Hierarchal mass scales in lattice gauge theories with dynamical, light fermions.** Kogut, J.; Polonyi, J.; Wyld, H.W.; Sinclair, D.K. (Department of Physics, University of Illinois at Urbana-Champaign, 1110 West Green Street, Urbana, Illinois 61801). *Physical Review Letters;* **54**: No. 18, 1980-1982(6 May 1985).

SU(2) lattice gauge theory with two Dirac species of light, adjoint fermions included in the dynamics is simulated at finite temperatures by use of the microcanonical algorithm. The theory contains two natural mass scales, the string tension for heavy, fundamental quarks, and the chiral-symmetry—breaking scale of light, adjoint quarks. The two scales are found to be distinct. This result generalizes earlier results obtained in the quenched approximation and should encourage builders of hierarchal models.

26357 **Sliding singlet mechanism in N = 1 supergravity GUT.** Sen, A. (Fermi National Accelerator Lab., Batavia, IL (USA)). *Physics Letters, [Section] B;* **148**: No. 1-3, 65-68(22 Nov 1984).

We show how the sliding mechanism may be successfully incorporated in SU(6) grand unified theories coupled to N = 1 supergravity, to keep the weak doublet Higgs light, while its color triplet partner acquires a large mass.

26358 **Perturbative QCD.** Hinchliffe, I. (Univ. of California, Berkeley). *AIP (American Institute of Physics) Conference Proceedings;* No. 81, 173-185(1982). (CONF-810986—). Contract W-7405-ENG-48.

From Meeting of the division of particles and fields of the American Physical Society; Santa Cruz, CA, USA (9 Sep 1981).

Selected aspects of perturbative QCD are reviewed. Topics covered include: general properties of the perturbative QCD expansion, onia decays, the Drell-Yan model, muon pair production, higher twist effects and scaling.

26359 **Comparison of weak interaction theory with experiment.** Wojcicki, S.G. (Stanford Univ., CA). *AIP (American Institute of Physics) Conference Proceedings;* No. 81, 316-374(1982). (CONF-810986—). Contract AC03-76SF00515.

From Meeting of the division of particles and fields of the American Physical Society; Santa Cruz, CA, USA (9 Sep 1981).

A comprehensive review of experimental data related to the Standard Model of Weak interactions is presented. Charged current processes and neutral current reactions are described and compared with theory. Alternative models are discussed and the extension of the Standard Model to six quarks and the effects of CP violation are considered.

26360 **Progress in grand unification.** Goldman, T. (Los Alamos National Lab., NM). *AIP (American Institute of Physics) Conference Proceedings;* No. 81, 522-537(1982). (CONF-810986—).

From Meeting of the division of particles and fields of the American Physical Society; Santa Cruz, CA, USA (9 Sep 1981).

The predictions and experimental status of the minimal SU_5 model are reviewed. Some alternative unification schemes, including those with lower unification scales, and their experimental implications are noted. The reduction in mass and coupling strength of the axion in grand unified theories is discussed along with Ramond's observation that the axion inducing (Peccei-Quinn) symmetry can suppress the mass scale of new fermion degrees of freedom down to the TeV level. The continuing unsolved problem of the fermion generations (lack of horizontal symmetry) is described. The attractive features of the SO(8) composite scenario of Ellis, Gaillard and Zumino are emphasized.

26361 **Monopoles and the early universe.** Weinberg, E.J. (Columbia Univ., New York, NY). *AIP (American Institute of Physics) Conference Proceedings;* No. 81, 538-547(1982). (CONF-810986—).

From Meeting of the division of particles and fields of the American Physical Society; Santa Cruz, CA, USA (9 Sep 1981).

Grand unified theories predict the existence of superheavy magnetic monopoles. Combining these theories with standard big bang cosmology appears to lead to the conclusion that an unacceptably large abundance of these would have been produced in the early universe. Several proposed mechanisms for suppressing the monopole abundance are reviewed.

65 PHYSICS. II.

6510 Nuclear Physics

REFER ALSO TO CITATION(S) 25680, 26421

26362 **(BNL-NCS—35794) International scope of data evaluation.** Pearlstein, S. (Brookhaven National Lab., Upton, NY (USA)). 1985. Contract AC02-76CH00016. 8p. (CONF-850610—13). NTIS, PC A02/MF A01; GPO Dep. File Number DE85005953.

From Annual meeting of the American Nuclear Society; Boston, MA, USA (9 Jun 1985).

This paper summarizes the principal national and international evaluation activities that contributed to the widespread use of evaluated data files. Emphasis is placed on those efforts that have become best known through the availability of data, documentation, and computer codes. Early attempts at nuclear data evaluation consisted of improving communication among measurers of similar information. As reactor methodology proceeded from a four factor formula to multi-group theory the demand for detailed representation of nuclear data increased. The systematic access to large volumes of data required placing the information in computer readable formats.

26363 **(CONF-850610—5) Energy-averaged nuclear data; measurements and physical interpretations.** Smith, A.B. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85006198.

From Annual meeting of the American Nuclear Society; Boston, MA, USA (9 Jun 1985).

The objective is an outline of the status of energy-averaged nuclear-data (unresolved-resonance region to 20 MeV) for a diversity of applications. The relevance is primarily to nuclear-energy systems (fission and fusion), and, secondarily, to a wide range of other nuclear applications. Neutron total cross sections, neutron scattering and emission, neutron radiative capture, neutron fission, neutron-induced activities and charged-particle production, and charged-particle processes are reviewed. (WHK)

26364 **(LBL—91-Rev.1-85) Current experiments in elementary particle physics. Revision 1-85.** Wohl, C.G.; Armstrong, F.E.; Rittenberg, A.; Trippe, T.G.; Yost, G.P.; Oyanagi, Y.; Dodder, D.C.; Grudtsin, S.N.; Ryabov, Yu.G.; Frosch, R. (Lawrence Berkeley Lab., CA (USA)). Jan 1985. Contract AC03-76SF00098. 47p. NTIS, PC E03/MF A01; GPO Dep. File Number DE85011513.

Includes 1 sheet of 48x reduction microfiche.

This report contains summaries of 551 approved experiments in elementary particle physics (experiments that finished taking data before 1 January 1980 are excluded). Included are experiments at Brookhaven, CERN, CESR, DESY, Fermilab, Moscow Institute of Theoretical and Experimental Physics, Tokyo Institute of Nuclear Studies, KEK, LAMPF, Leningrad Nuclear Physics Institute, Saclay, Serpukhov, SIN, SLAC, and TRIUMF, and also experiments on proton decay. Properties of the fixed-target beams at most of the laboratories are summarized. Instructions are given for searching online the computer database (maintained under the SLAC/SPIRES system) that contains the summaries.

26365 (NEANDC(J)—113/U) Chart of the nuclides. Yoshizawa, Y.; Horiguchi, T.; Yamada, M. (comps.). (Hiroshima Univ. (Japan). Dept. of Physics; Waseda Univ., Tokyo (Japan). Science and Engineering Research Lab.). 1984. 27p. (INDC(JPN)—99/L). NTIS (US Sales Only), PC A03/MF A01. File Number DE85901374.

The chart is color coded to indicate half-life and also coded to indicate the decay mode. Information included on the back side of the chart includes: periodic table, a table of fundamental constants, conversion tables, a tabulation of some physical constants of the elements, and a table of gamma-ray intensity standards. (WHK)

26366 (ORNL—6120) Physics Division progress report for period ending September 30, 1984. Livingston, A.B. (ed.). (Oak Ridge National Lab., TN (USA)). Jan 1985. Contract AC05-84OR21400. 277p. NTIS, PC A13/MF A01; 1; GPO Dep. File Number DE85006958.

The research activities of the Division are centered primarily in three areas: experimental nuclear physics, experimental atomic physics, and theoretical nuclear and atomic physics. The largest of these efforts, experimental nuclear physics, is dominated by the heavy ion research program. A major responsibility under this program is the operation of the Holifield Heavy Ion Research Facility as a national user facility. During the period of this report, the facility has begun routine operation for the experimental program. The experimental atomic physics program has two components: the accelerator-based studies of basic collisional phenomena and the studies in support of the controlled fusion program. Also associated with the fusion-related studies are a plasma diagnostics program and the operation of an atomic physics data center. The theoretical physics program, both nuclear and atomic, is covered. This program has benefited this year from the success of the VAX-AP computer system and from the increase in manpower provided by the ORNL/University of Tennessee Distinguished Scientist Program. Smaller programs in applications and high-energy physics are summarized. During the period of this report, we continued to explore possible future extensions of the Holifield Facility. We retain a strong interest in a relativistic heavy-ion collider in the 10 x 10 GeV/nuclear energy range. The ideas for such a facility, described in last year's report, have been modified to utilize the HHIRF 25 MV tandem accelerator as the first stage. Finally, the report concludes with some general information on publications, Division activities, and personnel changes.

6512 Nuclear Properties And Reactions, A=1-5

26367 (IPNO-DRE—83-37) Experimental search of structures in missing mass spectra of B = 2, T = 1 system: possible evidence for narrow states. Tatischeff, B.; Combes, M.P.; Didelez, J.P. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1984. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85750913.

The missing mass spectra for the transfer reaction p(^{3}He,d)X (B = 2, T = 1) have been measured at Tsub(^{3}He) = 2.7 GeV. The data show: 1) a narrow structure lying on top of an important continuum, with a mass M = 2.240 +- 0.005 GeV and a width GAMMAsub(1/2) = 0.16 +- .003 GeV; 2) a large structure with centroid location close to Msub(x) approximately equal to 2.170 +- .005 GeV and width GAMMAsub(1/2) approximately .100 +- .005 GeV.

26368 (IPNO-DRE—84-11) Search for t = O dibaryonic resonances. Experimental results on the d + d + d + X resonances. Combes, M.P.; Berthet, P.; Frascaria, R. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1984. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85750910.

A search for isoscalar dibaryonic resonances by means of missing mass spectra in the d + d → d + X reaction has been attempted using deuteron beams of T = 2.29, 2.00 and 1.65 GeV. The results do not show any evidence for a narrow peak with a limit of 0.03 pb/MeV^2 for a 15 MeV width or a broad enhancement which could be unambiguously attributed to a dibaryonic resonance.

6513 Nuclear Properties And Reactions, A=6-19

REFER ALSO TO CITATION(S) 26375

26369 (CONF-850507—2) Investigation of thick-target neutron emission from Be-9(d,n)B-10 at E/sub d/ = 7 MeV for angles other than zero degrees. Smith, D.L.; Meadows, J.W.; Guenther, P.T. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010254.

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Double-differential measurements of neutron emission from a thick beryllium target bombarded with 7-MeV deuterons are made for neutrons above 800 keV, over the angular range of 0 to 155°. The angular dependence of the neutron yield is found to be quite anisotropic. The importance of this anisotropy in integral neutron-induced reaction cross-section investigations is illustrated. 7 refs.,

26370 (DOE/ER/60142—2, pp 23-38) High energy neutron cross-sections and kerma values of biomedical interest calculated with a nuclear model applicable to light nuclei. Brenner, D.J. Jul 1984. NTIS, PC A18/MF A01. File Number DE84014885.

In Radiation physics, biophysics and radiation biology. Progress report, December 1, 1983-November 30, 1984.

A model has been developed for calculating fast neutron cross sections (E > 14 MeV) for light nuclei of biomedical interest. The model explicitly includes experimental nuclear structure information. Some calculations for ^{12}C, ^{14}N, and ^{16}O are presented.

26371 (IC—84/34) Parity violation in alpha decay. Carstoiu, F.; Dumitrescu, O.; Stratan, G.; Braic, M. (International Centre for Theoretical Physics, Trieste (Italy)). Apr 1984. 26p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85700549.

The Fermi liquid model of alpha decay and the shell model wave functions of Zucker, Buck and McGrory are used to calculate the "regular" and "irregular" (parity non-conserving) alpha widths of some Jsup(π)T = 2 +- ,O lowest lying levels of ^{16}O. The Pauli corrections in the alpha channel wave functions are taken into account.

26372 (IFUSP-P—435) Forward glory effects in the elastic scattering of ^{12}C + ^{12}C. Hussein, M.S.; Lepine-Szily, A.; Saad, M.M.; Villari, A.C.C. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Oct 1983. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700568.

It is shown that the elastic scattering of ^{12}C + ^{12}C in the center-of-mass energy range 6 < E < 31 MeV exhibits forward glory enhancement. Semiclassical analysis of the quantity $\Delta\sigma$ sub(R) > σ sub(R) - $\int$[sup(dσ) Ruth./dΩ - sup(dσ) el./dΩ] dΩ indicates that the best candidate for a ^{12}C + ^{12}C interaction potential is a small-radius, deep Woods-Saxon potential, in qualitative agreement with the results obtained from recent analyses of sup(dσ) el./dΩ done at higher energies.

26373 Elastic and inelastic scattering of 158 MeV ^{9}Be ions. Fulmer, C.B.; Satchler, G.R.; Erb, K.A.; Hensley, D.C.; Auble, R.L.; Ball, J.R.; Bertrand, F.E.; Gross, E.E. (Oak Ridge National Lab., TN (USA)). *Nuclear Physics [Section] A;* **427**: No. 3, 545-567(15 Oct 1984).

The elastic scattering of 158 MeV ^{9}Be ions was measured for seven targets ranging in mass from 12 to 197. Inelastic data for exciting the lowest 2$^+$ states of ^{12}C, ^{26}Mg and ^{60}Ni were also obtained. The elastic data for ^{12}C and ^{16}O show pronounced structures at the most forward angles which are rapidly damped as the scattering angle increases. The distributions for ^{26}Mg and ^{27}Al show marked structure with significant odd-even differences that can be ascribed to quadrupole scattering from the ^{27}Al ground state. The elastic data were analyzed using the optical model with both Woods-Saxon and folding-model potentials. The folded potentials are too strong and require renormalization; they do not give good fits to the data for the lighter targets. The inelastic data were compared to distorted-wave calculations.

6514 Nuclear Properties And Reactions, A=20-38

26374 (IC—84/19) Bound levels in ^{29}P populated in the ^{28}Si(^{3}He,d) reaction. Chowdhury, M.S.; Sen Gupta, H.M.; Shahabuddin, M.A.M. (International Centre for Theoretical Physics, Trieste (Italy)). Mar 1984. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700576.

Analyses of the angular distribution of deuterons from the ^{28}Si(^{3}He,d) reaction at 17 MeV leading to the bound levels in ^{29}P show that these are fairly well given by the single-step DWBA mechanisms and that the importance of a two-step process is negligible.

26375 (IFUSP-P—352) Yrast and high spin states in ^{22}Ne. Szanto, E.M.; Toledo, A.S. de; Klapdor, H.V.; Rosner, G.; Schrader, M. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Aug 1982. 52p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85700577.

High spin states in ^{22}Ne have been investigated by the reactions ^{11}B(^{13}C,d)^{22}Ne and ^{13}C(^{11}B,d)^{22}Ne up to E* approximately=19 MeV. Yrast states were observed at 11.02 MeV (8^+) and 15.46 MeV (10^+) excitation energy. A backbending in ^{22}Ne is observed around spin 8^+. The location of high spin states I <= 10 is discussed in terms of the rotational band structure, Strutinsky type calculations, and pure shell model predictions.

26376 (IFUSP-P—392) Statistical features of pre-compound processes in nuclear reactions. Hussein, M.S.; Rego, R.A. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Apr 1983. 28p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85700557.

Several statistical aspects of multistep compound processes are discussed. The connection between the cross-section auto-correlation function and the average number of maxima is emphasized. The restrictions imposed by the non-zero value of the energy step used in measuring the excitation fuction and the experimental error are discussed. Applications are made to the system ^{25}Mg(^{3}He,p)^{27}Al.

6515 Nuclear Properties And Reactions, A=39-58

REFER ALSO TO CITATION(S) 26396

26377 Nuclear data sheets for A = 53. Peker, L.K. (National Nuclear Data Center, Brookhaven National Laboratory Upton, New York 11973, USA). *Nuclear Data Sheets;* **43**: No. 4, 481-578(Dec 1984). Contract AC02-76CH00016.

The experimental nuclear structure data available through December 1983 have been reviewed. A summary of information obtained in varius reaction and decay experiments are presented, together with adopted level schemes.

26378 ^{51}V(p,n)^{51}Cr reaction at Esub(p)=160 MeV. Rapaport, J.; Alarcon, R. (Ohio Univ., Athens (USA)); Brown, B.A. (Michigan State Univ., East Lansing (USA)); Gaarde, C.; Larsen, J. (Niels Bohr Inst., Copenhagen (Denmark)); Goodman, C.D.; Foster, C.C. (Indiana Univ., Bloomington (USA)); Horen, D. (Oak Ridge National Lab., TN (USA)); Masterson, T. (Colorado Univ., Boulder (USA)); Sugarbaker, E. (Ohio State Univ., Columbus (USA)). *Nuclear Physics [Section] A;* **427**: No. 2, 332-356(8 Oct 1984).

The ^{51}V(p,n)^{51}Cr reaction has been studied at Esub(p) = 160 MeV using the Indiana University beam-swinger facility. Data have been obtained at several angles up to THETAsub(L) = 20°. The 0° spectrum is used to obtain a $\Delta L = 0$ response function from which Gamow-Teller strength is derived. A shell-model calculation of the GT strength distribution is presented and compared with the experimental results. The M1 strength is also calculated and compared with available results from (e,e') and (p,p') experiments. A comparison is made with other N = 28 nuclei. Effects of a truncated shell-model space are presented.

6516 Nuclear Properties And Reactions, A=59-89

26379 Investigation of the ^{59}Co(n,γ)^{60}Co reaction with unpolarized and polarized neutrons. Kopecky, J. (Stichting Energieonderzoek Centrum Nederland, Petten. Nuclear Structure Group); Delfini, M.G. (Stichting Energieonderzoek Centrum Nederland, Petten. Nuclear Structure Group; Rijksuniversiteit Utrecht (Netherlands). Fysisch Lab.); Chrien, R.E. (Brookhaven National Lab., Upton, NY (USA)). *Nuclear Physics [Section] A;* **427**: No. 3, 413-450(15 Oct 1984).

Capture of 24 keV neutrons and polarized as well as unpolarized thermal neutrons in ^{59}Co has been investigated. Of the 350 γ-rays observed 335 could be placed in a ^{60}Co level scheme containing 144 levels. The reaction Q-value amounts to 7491.92(8) keV. The chi^2 analysis of the circularly polarized γ-rays results in 31 unambiguous spin assignments for ^{60}Co levels. The fraction of the $J=4^-$ channel in the thermal capture was determined to be (80 +- 1)%. An average γ-ray multiplicity of 2.3 gammas per neutron capture was observed. The resulting level scheme is compared to shell-model predictions. Possible reaction mechanisms are discussed.

26380 Analog giant dipole Ni(n,p) at 59.6 MeV. Ullmann, J.L.; Brady, F.P.; Castaneda, C.M.; Fitzgerald, D.H.; Needham, G.A.; Romero, J.L. (California Univ., Davis (USA). Dept. of Physics; California Univ., Davis (USA). Crocker Nuclear Lab.); King, N.S.P. (Los Alamos National Lab., NM (USA)). *Nuclear Physics [Section] A;* **427**: No. 3, 493-510(15 Oct 1984).

A broad enhancement above the continuum observed in sup(58,60,62,64)Ni(n,p) at 59.6 MeV is interpreted as the parent analog of the T > component of the giant dipole resonance. A continuum parameterization is used to extract the resonance cross section. The angular distributions for the state are most consistent with the Steinwedel-Jensen model for the giant dipole. The sum-rule strength is somewhat greater than observed with photonuclear measurements. A measurement of the blocking of the cross section with neutron excess is made, and is consistent with theoretical predictions.

26381 β-decay of ^{76}Rb and the level structure of ^{76}Kr. Moltz, D.M.; Toth, K.S. (Oak Ridge National Lab., TN (USA)); Avignone, F.T. III; Noma, H. (South Carolina Univ., Columbia (USA)); Kern, B.D. (Kentucky Univ., Lexington (USA)); Tribble, R.E.; Sullivan, J.P. (Texas A and M Univ., College Station (USA)). *Nuclear Physics [Section] A;* **427**: No. 2, 317-331(8 Oct 1984).

The β-decay of mass-separated ^{76}Rb and the ^{78}Kr(^{4}He,^{6}He) reaction at Esub(lab) = 102.7 MeV were used to investigate levels in ^{76}Kr. Based on these data and published results from in-beam and (p,t) studies, a decay scheme for ^{76}Rb was constructed which incorporates 38 transitions and 16 excited levels in ^{76}Kr. The decay data strongly suggest a Jsup(π) of 1^- for the ground state of ^{76}Rb rather than the accepted assignment of 1^+. Nilsson-model calculations were made with several combinations of neutron and proton configurations that reproduce Jsup(π) = 1^- and the experimental magnetic moment for ^{76}Rb.

6517 Nuclear Properties And Reactions, A=90-149

REFER ALSO TO CITATION(S) 26384, 26385

26382 (BNL—36234) Antiproton-nucleus inelastic scattering and the spin-isospin dependence of the N anti N interaction. Dover, C.B. (Brookhaven National Lab., Upton, NY (USA)). 1985. Contract AC02-76CH00016. 21p. (CONF-850152—4). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010546.

From 3. LEAR workshop; Tignes-Savoie, France (19 Jan 1985).

A general overview of the utility of antinucleon (anti N)-nucleus inelastic scattering studies is presented, emphasizing both the sensitivity of the cross sections to various components of the N anti N transition amplitudes and the prospects for the exploration of

some novel aspects of nuclear structure. We start with an examination of the relation between NN and N anti N potentials, focusing on the coherences predicted for the central, spin-orbit and tensor components, and how these may be revealed by measurements of two-body spin observables. We next discuss the role of the nucleus as a spin and isospin filter, and show how, by a judicious choice of final state quantum numbers (natural or unnatural parity states, isospin transfer $\Delta T=0$ or 1) and momentum transfer q, one can isolate different components of the N anti N transition amplitude. Various models for the N anti N interaction which give reasonable fits to the available two-body data are shown to lead to strikingly different predictions for certain spin-flip nuclear transitions. We suggest several possible directions for future anti N-nucleus inelastic scattering experiments at LEAR, for instance the study of spin observables which would be accessible with polarized anti N beams, charge exchange reactions, and higher resolution studies of the (anti p, anti p') reaction. We compare the antinucleon and the nucleon as a probe of nuclear modes of excitation. 34 refs.

26383 (IFUSP-P—354) Upper limit of peak area. Helene, O.A.M. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Aug 1982. 17p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700572.

The determination of the upper limit of peak area in a multichannel spectra, with a known significance level is discussed. This problem is specially important when the peak area is masked by the background statistical fluctuations. The problem is exactly solved and, thus, the results are valid in experiments with small number of events. The results are submitted to a Monte Carlo test and applied to the ^{93}Nb beta decay.

26384 (IFUSP-P—419) ^{130}Te (p,p') reaction on analog resonances. Martinez Ruiz, M.delC.H.; Cescato, M.L.; Foster Junior, J.L.; Krmpotic, F. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Jul 1983. 42p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85700563.

Angular distributions for elastic and inelastic scattering have been measured on six analog resonances in the ^{130}Te + p system and at two off resonance energies. Partial widths are deduced from the angular distributions. Formulae for the spectroscopic amplitudes within the framework of quasiparticle random phase approximation are presented. The experimental results are compared with the theoretical predictions.

26385 (IFUSP-P—420) ^{144}Sm (p,p') scattering through isobaric analog resonances and the structure of ^{145}Sm. Cescato, M.L.; Martinez Ruiz, M.delC.H.; Foster Junior, J.L.; Krmpotic, F. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Jul 1983. 55p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85700564.

Angular distributions of the cross section for the elastic and inelastic scattering of protons have been measured at four isobaric analog resonances of the ^{144}Sm + p system and at two off-resonance energies. Spectroscopic information about the $7/2^-_1$, $3/2^-_1$, $1/2^-_1$ and $5/2^-_1$ states of the parent nucleus ^{145}Sm is extracted, with the core ^{144}Sm in the states 0^+_1, 2^+_1, 3^-_1, 4^+_1 and 2^+_2. The analysis includes direct and fluctuating non-resonant processes. The direct scattering amplitude is obtained from a coupled channel treatment. Different methods for the calculations of the single-particle widths have been employed. The experimental spectroscopic amplitudes were confronted with nuclear structure calculations based on the particle-vibrator model. Both the liquid drop model and the quasi-particle random phase approximation were used to describe the vibrator. The calculations based on the later model show good agreement with the experimental results.

6518 Nuclear Properties And Reactions, A=150-189

26386 (IFUSP-P—403) Coulomb excitation of ^{189}Os. Jha, S.; Seale, W.A.; Ribas, R.V.; Cybulska, E.W.; Rao, M.N.; Rogers, J.D.; Julian, G.M. (Sao Paulo Univ. (Brazil). Inst. de Fisica). May 1983. 8p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700561.

Coulomb excitation studies have been performed on enriched ^{189}Os target with 56 MeV ^{16}O beam. Gamma rays were measured in coincidence with the back scattered ^{16}O ions. Rotational bands built on $3/2^-$ (512), $1/2^-$ (510) up to spin 11/2 have been identified.

6519 Nuclear Properties And Reactions, A=190-219

REFER ALSO TO CITATION(S) 26388, 26395

26387 (IC—84/41) Band crossings in mercury nuclei: effect of occupation of i13/2 neutron orbits. Khadkikar, S.B.; Praharaj, C.R. (International Centre for Theoretical Physics, Trieste (Italy)). Apr 1984. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700550.

The $K = 0^+$ ground band and two rotation-aligned bands ($K = 1^+$ or $K2^+$ two quasi-particle band and $K = 2^+$ four quasi-particle band) are studied in ^{198}Hg, ^{194}Hg and ^{190}Hg by angular momentum projection from Hartree-Fock and particle-hole intrinsic states. There is a first anomaly in these three nuclei around $8(\hbar/2\pi)$ due to the crossing of the ground band and the two quasi-particle band. Because of the nature of occupation of i13/2 orbitals the four quasi-particle band is too high lying in ^{198}Hg and does not cross the two quasi-particle bands, while such a second crossing occurs in ^{194}Hg and ^{190}Hg near 20 $(\hbar/2\pi)$.

26388 (IFUSP-P—347) Evidence for M1 strength in ^{197}Au. Campos, M.C.A.; Gouffon, P.; Miyao, Y.; Wolynec, E.; Martins, M.N.; Moscati, G. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Jul 1982. 13p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700578.

The (e,n) cross section for ^{197}Au was measured and the results analyzed using the known (y,n) cross section and DWBA virtual photon spectra. The (y,n) cross section contains an E2 component exhausting 66 +- 26 percent of the isoscalar E2 sum and an M1 component in the threshold region with a strength of 18.9 +- 1.2Mev.mb. It is shown that the electrodisintegration cross section is very sensitive to M1 absorption and the technique can be used for other nuclei.

6520 Nuclear Properties And Reactions, A=220 And Above

26389 (CBPF-NF—022/82) Cluster approach to intranuclear cascade for relativistic heavy ion collisions. Kodama, T.; Duarte, S.B.; Chung, K.C.; Nazareth, R.A.M.S. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1982. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700555.

A new approach to the intranuclear cascade model for relativistic heavy ion reaction is presented. The effect of nucleon concentration on the collision process is explicitly included. It is found that the contributions from the non-binary processes are far from being negligible. Such processes are shown to broaden the angular distribution of inclusive proton spectra for ^{20}Ne + ^{238}U head-on collisions.

26390 (IFUSP-P—423) Coincident-inclusive electrofission angular correlations. Arruda Neto, J.D.T. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Aug 1983. 34p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85700573.

A method for the joint analysis of coincident and inclusive electrofission data, in order to minimize effects of the model dependence of data interpretation, is developed. Explicit calculations of the (e,e'f) angular correlations are presented. The potentialities of the method to the study of sub- and near-barrier properties of the fission process, and to the study of the giant resonances fission mode, are discussed.

26391 (IFUSP-P—438) Splitting of isoscalar giant resonances in actinide nuclei. Arruda Neto, J.D.T. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Nov 1983. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700569.

The strength distribution of the isoscalar Giant Quadrupole Resonance (GQR) for actinide nuclei, obtained from photon-, electron- and hadron- induced reactions, is analyzed in terms of a

cranking model for the fragmentation of the GQR. The role played by the low-lying E2- strength for the correct delineation of the GQR parameters is presented.

26392 (IFUSP-P—440) Photofission of ^{232}Th. Arruda Neto, J.D.T.; Rigolon, W.; Herdade, S.B.; Riette, H.L. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Nov 1983. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700574.

The bremsstrahlung-induced fission cross section of ^{232}Th was measured in the energy region of the Giant Dipole Resonance. The data analysis, performed in terms of the bremsstrahlung spectrum calculated in the Davies-Bethe-Maximon approximation, suggested that the photofission cross section measured at Livermore is correct, and that the (γ,f) data from Saclay are highly questionable.

26393 (UCRL—92439) Experimental level-structure determination in odd-odd actinide nuclei. Hoff, R.W. (Lawrence Livermore National Lab., CA (USA)). 4 Apr 1985. Contract W-7405-ENG-48. 14p. (CONF-8504107—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010476.

From 35. national conference on nuclear spectroscopy and structure of atomic nuclei; Leningrad, USSR (16 Apr 1985).

The status of experimental determination of level structure in odd-odd actinide nuclei is reviewed. A technique for modeling quasiparticle excitation energies and rotational parameters in odd-odd deformed nuclei is applied to actinide species where new experimental data have been obtained by use of neutron-capture gamma-ray spectroscopy. The input parameters required for the calculation are derived from empirical data on single-particle excitations in neighboring odd-mass nuclei. Calculated configuration-specific values for the Gallagher-Moszkowski splittings are used. Calculated and experimental level structures for ^{238}Np, ^{244}Am, and ^{250}Bk are compared, as well as those for several nuclei in the rare-earth region. The agreement for the actinide species is excellent, with bandhead energies deviating 22 keV and rotational parameters 5%, on the average. Applications of this modeling technique are discussed.

26394 (ZfI-Mitt—86, pp 5-37) Composition of fission product mixtures. Roessler, M. Apr 1984. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE85780871.

In Reports of the Central Institute for Isotopes and Radiation Research.

The report gives a compilation of the isotopic composition and specific activity of fission products produced by thermal neutron fission of U-235 and Pu-239. The composition was computed using an electronic computer ES 1040. The presentation comprises data of 27 elements at the end of a neutron irradiation of 3 years and after a time interval of 1, 4 and 10 years after the end of irradiation.

6530 Nuclear Theory

26395 (BNL—36119) Boson-fermion symmetries in the W-Pt region. Warner, D.D. (Brookhaven National Lab., Upton, NY (USA)). 1985. Contract AC02-76CH00016. 21p. (CONF-850159—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85009755.

From 8. symposium on nuclear physics; Oaxtepec, Mexico (8 Jan 1985).

The concept of symmetry in the Interacting Boson Model (IBM) description of even-even nuclei has proved to be one of the model's most important elements, because they provide benchmarks in the formulation of a unified description of a broad range of nuclei. The importance of the recently proposed symmetries in odd-even systems can thus be viewed in the same light, and their role in pointing to a simple prescription for the changing collective structure in odd A nuclei throughout a major shell is likely to prove even more essential, given the much greater complexity of the boson-fermion (IBFM) Hamiltonian. The group structure of a boson-fermion system is described by U/sup B/(6) x U/sup F/(m) where m specifies the number of states available to the odd fermion, and thus depends on the single particle space assumed. The ability to construct group chains corresponding to the symmetries SU(5), SU(3) or 0(6) depends on the value of m. Of the structures studied in detail to date, the case of m = 12 is the one with the broadest potential. The fermion is allowed to occupy orbits with j = 1/2, 3/2 and 5/2, so that the assumed single particle space corresponds to the negative parity states available to an odd neutron at the end of the N = 82-126 shell, namely, P/sub 1/2/, p/sub 3/2/ and f/sub 5/2/. The region of interest thus spans the W-Pt nuclei, and since one prerequisite for an odd-A symmetry is the existence of that same symmetry in the neighboring even-even core nucleus, the odd Pt nuclei around A = 196 offer the obvious testing ground for the 0(6) limit of U(6/12). The heavier even-even W nuclei, on the other hand, have the characteristics of an axial rotor, and hence the negative parity structure of the neighboring odd W isotopes offers the possibility to study the validity of the SU(3) limit. Given a definition and understanding of these two limits, the construction of a simple description of the transitional Os nuclei can be considered.

26396 (CONF-850376—1) Fusion reactions at low energy. Beckerman, M. (Oak Ridge National Lab., TN (USA)). 1985. Contract AS05-76ER04936;AC05-84OR21400. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010561.

From Symposium on semiclassical descriptions of atomic and nuclear collisions; Copenhagen, Denmark (25 Mar 1985).

Fusion measurement methods at low energies are briefly described, and experimental and theoretical fusion cross sections for ^{58}Ni + ^{58}Ni, ^{58}Ni + ^{64}Ni and ^{64}Ni + ^{64}Ni reactions are discussed. It is shown that quantal tunneling calculations do not describe the near- and sub-barrier behavior of the fusion data. Instead, the WKB predictions fall progressively further blow the experimental results as the energy is lowered. At far subbarrier energies the measured cross sections exceed the WKB predictions by more than three orders of magnitude. The unexpectedly strong dependence of the fusion probability upon the nuclear valence structure is illustrated and discussed. The relationship of channel coupling and quantal tunneling is discussed. In conclusion, it was established that atomic nuclei fuse far more readily at low energies that would be expected from quantal tunneling considerations alone. It was found that the behavior of the cross sections for fusion depends strongly upon the valence structure of the collision partners. This structural dependence extends from light 1p-shell systems to systems involving nearly 200 nucleons. These new phenomena may be viewed as characterizing the tunneling of a quantal system with many degrees of freedom. The failure of standard tunneling models may be understood as resulting from the ability of the dinuclear system to tunnel into the classically forbidden region by means of couplings to intrinsic degrees of freedom. 38 refs. (WHK)

26397 (CONF-8503120—2) Deep-inelastic lepton scattering by nuclei. The pion-exchange model. Coester, F.; Berger, E.L. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010498.

From Hadronic probes and nuclear interactions conference; Tempe, AZ, USA (11 Mar 1985).

Quark constituents of nucleons were discovered in deep-inelastic electron scattering. It is not surprising therefore that the nuclear effects in deep-inelastic lepton scattering first observed by the European Muon Collaboration (EMC) have spawned many suggestions of revolutionary changes in our views of nuclear structure. Perhaps quarks play a far more active role in nuclear dynamics than the conventional theory provides. Before following the natural appeal of radical conclusions we believe it is important to examine in quantitative detail the consequences of the conventional nuclear model, in which the nucleon-nucleon potential features a one-pion exchange tail at large distances, an intermediate range attraction dominated by two-pion exchange and a strong short-range phenomenological repulsion. For this purpose let us assume that quarks are strictly confined to single hadrons, and that the quark structure of the hadrons in a nucleus is not affected by their environment. These assumptions allow a consistent description of deep-inelastic lepton-nucleus scattering, and the quantitative consequences agree well with available data. 15 refs.

26398 (IC—84/45) Effective interactions in p-shell nuclei and the realistic interactions - I. Upadhyaya, G.K.; Joshi, K.P. (International Centre for Theoretical Physics, Trieste (Italy)). Apr 1984. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700551.

The effective interaction of Jain et al. derived from the Yale interaction by including the prominent core polarization diagrams is analyzed in terms of the interaction radial integrals and their spin tensor components. The interaction is also compared with some phenomenological effective interactions. The general features of the effective force in the ^{1}p shell region are discussed.

26399 (IFUSP-P—335) Nested-doorway model of multistep compound processes. Hussein, M.S. (Sao Paulo Univ. (Brazil). Inst. de Fisica). May 1982. 44p. (CONF-8206132—3). NTIS (US Sales Only), PC A03/MF A01. File Number DE85700556.

From Nuclear reaction mechanism conference; Varenna, Italy (14 Jun 1982).

The multistep compound contribution to preequilibrium reaction are discussed within the nested-doorway model. Emphasis is placed on the generalized cross-section auto-correlation function. Several of the more widely used concepts in the conventional, one-class, statistical analysis are discussed and generalized to the multi-class case. A summary of the formal results of the nested-doorway model, obtained within Feshbach's projection operator theory is given.

26400 (IFUSP-P—382) Hydrodynamic models for the giant dipole resonance. Arruda Neto, J.D.T. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Jan 1983. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700552.

The interplay between the experimental photonuclear E1-form factors and the theoretical predictions of the Goldhaber-Teller, Steinwedel-Jensen, and Droplet models was investigated. It was found that the Goldhaber-Teller displacement mode alone describes the main trend of the experimental form factors, as a function of the mass number. Also, it was verified that the Droplet model, while describing well the centroid energy of the E1-resonances, does not describe the form factors in terms of a mixture of the Goldhaber-Teller and Steinwedel-Jensen modes.

26401 (IFUSP-P—394) Analysis of stripping to isolated analog resonances. Pessoa, E.F.; Toledo Piza, A.F.R. de. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Apr 1983. 23p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700558.

The Feshbach projection formalism is used to calculate the form factors for the (d,n) stripping process to isolated analog resonances. These are used in a standard DWBA stripping calculation in which the radial integration over all space is accomplished by including outerspace contributions evaluated along the complex contours of Vincent and Fortune. It turns out that the shape and magnitude of the predicted cross section is quite insensitive to the continuum proton wave emanating from the resonant residual state.

26402 (IFUSP-P—398) Role of the L=1 baryon excitation in the giant electric dipole resonances. Coutinho, F.A.B.; Krmpotic, F. (Sao Paulo Univ. (Brazil). Inst. de Fisica). May 1983. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700553.

A simple estimate, based on the quark model, is made of the effect of the odd parity baryon resonances N^* and Δ^* on the vector dipole excitations in the nucleus. Although the coupling between the nuclear and baryon L = 1 degrees of freedom seems to be quite more relevant for the vector dipole fields than for the corresponding axial-vector ones, it still represents a minor effect.

26403 (IFUSP-P—400) Decay properties of overlapping nuclear resonances. Hussein, M.S.; Kerman, A.K.; McVoy, K.W. (Sao Paulo Univ. (Brazil). Inst. de Fisica). May 1983. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700559.

The decay properties of overlapping compound nucleus resonances are discussed. It is argued that the correlation width of Agassi, Weidenmuller and Mantzouranis is to be identified with the average total width of Kawai, Kerman and McVoy. It is also shown that in the very strong coupling limit, the compound system behaves like a system with isolated resonances (weak absorption).

26404 (IFUSP-P—401) Statistical aspects of multistep processes in nuclear reactions. Hussein, M.S. (Sao Paulo Univ. (Brazil). Inst. de Fisica). May 1983. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700560.

Several statistical aspects of nuclear multistep processes are discussed. The connection between the cross-section auto-correlation function and the average number of maxima in the excitation function is emphasized in the case of multistep compound (pre-compound) processes. The energy average angular distributions of transitions to specific final states proceeding through these processes are discussed in light-and heavy-ion induced reactions.

26405 (IFUSP-P—406) Particle-hole Random-phase-approximation with good isospin. Krmpotic, F.; Malta, C.P.; Nakayama, K. (Sao Paulo Univ. (Brazil). Inst. de Fisica). May 1983. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700554.

A simple method is designed for the treatment of a charge-independent Hamiltonian with wave function with good isospin and for nuclei with N not = Z. Both the particle-hole and the Δ-isobar-hole excitations are considered.

26406 (IFUSP-P—408) Average angular distribution of emitted particles in multi-step compound processes. Bonetti, R.; Carlson, B.V.; Hussein, M.S.; Toledo, A.S. de. (Sao Paulo Univ. (Brazil). Inst. de Fisica). May 1983. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700562.

A simple model for the differential cross-section that describes the angular distribution of emitted particles in heavy-ion induced multi-step compound reactions, is constructed. It is suggested that through a careful analysis of the deviations of the experimental data from the pure Hauser-Feshbach behaviour may shed light on the physical nature of the pre-compound, heavy-ion configuration.

26407 (IFUSP-P—422) Probing the interior region of the heavy ion interaction through alas. Hussein, M.S.; Canto, L.F.; Donangelo, R.J. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Aug 1983. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700565.

It is proposed that a careful study of the 180°-excitation function of elastically scattered light heavy-ion systems may reveal important information concerning the ion-ion interaction at small distances. This is accomplished by demonstrating the sensitivity of the anomalous energy-window to the distance of closest approach of the corresponding multi-step α-particle transfer process.

26408 (IFUSP-P—428) Channel non-orthogonality effects on the heavy-ion transfer polarization potential. Hussein, M.S.; Canto, L.F.; Donangelo, R.J. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Sep 1983. 9p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700566.

The channel-nonorthogonality correction to the heavy-ion transfer polarization potential is discussed.

26409 (IFUSP-P—433) Photoneutron cross sections measured by Saclay and Livermore. Wolynec, E.; Martinez, A.R.V.; Gouffon, P.; Miyao, Y.; Serrao, V.A.; Martins, M.N. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Oct 1983. 18p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700567.

The differences between the Saclay and Livermore photoneutron cross sections are discussed. It is shown that the differences between Saclay and Livermore (γ,n) and (γ,2n) cross sections arise from the neutron multiplicity sorting.

26410 (IFUSP-P—442) Small effects in sub-barrier heavy-ion elastic scattering. Hussein, M.S.; Franzin, V.L.M.; Franzin, R.; Baltz, A.J. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Dec 1983. 42p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85700570.

The effects of virtual Coulomb excitation of giant multipole resonances as well as of relativity on sub-barrier elastic scattering of heavy-ions are investigated. Closed expressions for the effect of giant quadrupole and octopole excitation from the adiabatic polarization potential, on the elastic scattering differential cross section, are derived. Comparison with optical model and coupled channels calculations is reported. The effect of special relativity on the Rutherford cross section is also described in a closed form.

26411 (IFUSP-P—443) Nuclear structure effects in heavy-ion elastic scattering. Hussein, M.S. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Dec 1983. 27p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85700571.

Heavy-ion elastic scattering is discussed as containing two features; over all optical behavior characterized by several physical parameters such as the size of the system, the strength of the Coulomb interaction, etc., and deviations from this behaviour related directly to some aspects of the underlying nuclear structure. Two examples of such deviations are discussed in detail. The first is the anomalous back-angle scattering of nα-nuclei. The second example is connected with the effect of deformation.

26412 (LA-UR—85-1439) Nuclear structure problems in double beta decay. Haxton, W.C.; Stephenson, G.J. Jr. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 9p. (CONF-8410224—5). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010739.

From AIP conference on neutrino mass and gauge structure of weak interaction; Cable, WI, USA (24 Oct 1984).

We summarize some of the nuclear structure issues in theoretical treatments of BB decay, emphasizing several of the less well-tested approximations commonly made. 16 refs.

26413 (TRI-PP—85-11) Relativistic meson-exchange NN-interaction and nuclear matter in the Dirac-Brueckner approach. Machleidt, R.; Brockmann, R. (British Columbia Univ., Vancouver (Canada). TRIUMF Facility; Bonn Univ. (Germany, F.R.). Inst. fuer Theoretische Kernphysik; Regensburg Univ. (Germany, F.R.). Inst. of Theoretical Physics). Mar 1985. 12p. (CONF-850163—2). NTIS (US Sales Only), PC A02/MF A01. File Number DE85901288.

From Workshop on Dirac approaches to nuclear physics; Los Alamos, NM, USA (31 Jan 1985).

Starting from the full Bonn meson-exchange model for the NN-interaction an OBEP is constructed in the framework of the Thompson version of the Blankenbecler-Sugar reduction of the Bethe-Salpeter equation. The pseudo-vector coupling of the pion to the nucleon is assumed. An excellent quantitative description of the deuteron and the latest phase-shift analyses of NN-scattering is achieved. This potential is applied to the system of infinite nuclear matter in the relativistic Dirac-Brueckner approach. Due to additional strongly density dependent relativistic saturation effects, which do not occur in conventional Brueckner theory, the empirical saturation energy and density of nuclear matter are reproduced. This potential may serve as a good starting point for the evaluation of the optical potential to be applied in nucleon-nucleus scattering. 36 refs.

26414 Currents in superfluid rotating nuclei. Durand, M.; Schuck, P. (Institut des Sciences Nucleaires, 38 - Grenoble (France)); Kunz, J. (Los Alamos National Laboratory, NM (USA)). *Journal de Physique (Paris), Colloque;* **45**: 143-152(Jun 1984). (CONF-840395—).

From Workshop on semi-classical methods in nuclear physics; Grenoble, France (5 Mar 1984).

The pairing effects are included in the calculation of the currents in a rotating nucleus by means of the single particle density. The correction to the density due to the rotating field may be shared into two parts: the first one depends only on the constant pairing field Δ but leads to no current in the laboratory frame for high Δ values. The second part depends on the reaction of the pairing field to the rotational field and leads to the expected irrotational current flow.

26415 Electromagnetic and weak currents in nuclei. Donnelly, T.W. (Massachusetts Institute of Technology, Cambridge). pp 1-33 of Symmetries in nuclear structure. Abrahams, K.; Allaart, K.; Dieperink, A.E.L. (eds.). New York, NY; Plenum Publishing Corporation (1983). Contract AC02-76ER03069.

Topics covered include electron scattering from a point Dirac proton, electron scattering from physical nucleons, inclusive and exclusive electron scattering, excitation of discrete states, and charge-changing semi-leptonic interactions.

6540 Radiation And Shielding Physics

REFER ALSO TO CITATION(S) 26009, 26046, 26310, 26318

26416 (LA—10227-C-Vol.1) Proceedings of the 1984 workshop on high-energy excitations in condensed matter. Volume I. Silver, R.N. (comp.). (Los Alamos National Lab., NM (USA)). Dec 1984. Contract W-7405-ENG-36. 344p. (CONF-840264—Vol.1). NTIS, PC A15/MF A01; 1; GPO Dep. File Number DE85007396.

From Workshop on high energy excitations in condensed matter; Los Alamos, NM, USA (13 Feb 1984).

This volume covers neutron scattering inelastic instrumentation, x-ray scattering inelastic instrumentation, and magnetic excitations. (GHT)

26417 (LA-UR—85-400) New slab geometry radiation transport differencing scheme. Larsen, E.W.; Morel, J.E.; Miller, W.F. Jr. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 8p. (CONF-850610—14). NTIS, PC A02/MF A01; GPO Dep. File Number DE85006681.

From Annual meeting of the American Nuclear Society; Boston, MA, USA (9 Jun 1985).

Considerable effort has been directed toward seeking an optimal spatial differencing scheme for the neutron transport equation. This search led to a best scheme (using specific criteria to define "best"): the linear characteristic method. However, we have recently considered radiative transfer problems in which the same problem may have both optically thick and optically thin regions, with the maximum optical thicknesses being much greater than those generally encountered in neutron transport problems. Here, we describe the important features of these radiative transfer problems and a new differencing scheme which seems to have advantages for radiative transfer calculations relative to the older schemes.

26418 (LA-UR—85-1174) MCNP: a general Monte Carlo code for neutron and photon transport. Forster, R.A.; Godfrey, T.N.K. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 23p. (CONF-8504110—17). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010764.

From Joint Los Alamos/CEA meeting on Monte Carlo methods; Cadarache, France (22 Apr 1985).

MCNP is a very general Monte Carlo neutron photon transport code system with approximately 250 person years of Group X-6 code development invested. It is extremely portable, user-oriented, and a true production code as it is used about 60 Cray hours per month by about 150 Los Alamos users. It has as its data base the best cross-section evaluations available. MCNP contains state-of-the-art traditional and adaptive Monte Carlo techniques to be applied to the solution of an ever-increasing number of problems. Excellent user-oriented documentation is available for all facets of the MCNP code system. Many useful and important variants of MCNP exist for special applications. The Radiation Shielding Information Center (RSIC) in Oak Ridge, Tennessee is the contact point for worldwide MCNP code and documentation distribution. A much improved MCNP Version 3A will be available in the fall of 1985, along with new and improved documentation. Future directions in MCNP development will change the meaning of MCNP to Monte Carlo N Particle where N particle varieties will be transported.

26419 (LA-UR—85-1207) Low-discrepancy point sets in transport codes. Warnock, T.T. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 20p. (CONF-8504110—16). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010786.

From Joint Los Alamos/CEA meeting on Monte Carlo methods; Cadarache, France (22 Apr 1985).

A drawback to Monte Carlo methods of computation is its rate of convergence. There are methods of sampling that have a better error estimate than those using random numbers. This paper gives the result of some preliminary experiments with these sampling methods on two neutron transport problems.

26420 (LA-UR—85-1224) Monte Carlo alpha calculation. Brockway, D.; Soran, P.; Whalen, P. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 11p. (CONF-8504110—6). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010720.

From Joint Los Alamos/CEA meeting on Monte Carlo methods; Cadarache, France (22 Apr 1985).

A Monte Carlo algorithm to efficiently calculate static alpha eigenvalues, N = ne/sup αt/, for supercritical systems has been developed and tested. A direct Monte Carlo approach to calculating a static alpha is to simply follow the buildup in time of neutrons in a supercritical system and evaluate the logarithmic derivative of the neutron population with respect to time. This procedure is expensive, and the solution is very noisy and almost useless for a system near critical. The modified approach is to convert the time-dependent problem to a static α^- eigenvalue problem and regress α on solutions of $a^- k^-$ eigenvalue problem. In practice, this procedure is much more efficient than the direct calculation, and produces much more accurate results. Because the Monte Carlo codes are intrinsically three-dimensional and use elaborate continuous-energy cross sections, this technique is now used as a standard for evaluating other calculational techniques in odd geometries or with group cross sections.

26421 (LA-UR—85-1243) High-energy particle Monte Carlo at Los Alamos. Prael, R.E. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 12p. (CONF-8504110—13). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010716.

From Joint Los Alamos/CEA meeting on Monte Carlo methods; Cadarache, France (22 Apr 1985).

A major computational effort at Los Alamos has been the development of a code system based on the HETC code for the transport of nucleons, pions, and muons. The Los Alamos National Laboratory version of HETC utilizes MCNP geometry and interfaces with MCNP for the transport of neutrons below 20 MeV and photons at any energy. A major recent effort has been the development of the PHT code for treating the gamma cascade in excited nuclei (the residual nuclei from an HETC calculation) by the Monte Carlo method to generate a photon source for MCNP. The HETC/MCNP code system has been extensively used for design studies of accelerator targets and shielding, including the design of LAMPF-II. It is extensively used for the design and analysis of accelerator experiments. Los Alamos National Laboratory has been an active member of the International Collaboration on Advanced Neutron Sources; as such we engage in shared code development and computational efforts. In the past few years, additional effort has been devoted to the development of a Chen-model intranuclear cascade code (INCA1) featuring a cluster model for the nucleus and deuteron pickup reactions. Concurrently, the INCA2 code for the breakup of light, excited nuclei using the Fermi breakup model has been developed. Together, they have been used for the calculation of neutron and proton cross sections in the energy ranges appropriate to medical accelerators, and for the computation of tissue kerma factors.

26422 (LA-UR—85-1293) Methods of Monte Carlo electron transport in particle-in-cell codes. Kwan, T.J.T.; Snell, C.M. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 9p. (CONF-8504110—7). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010702.

From Joint Los Alamos/CEA meeting on Monte Carlo methods; Cadarache, France (22 Apr 1985).

An algorithm has been implemented in CCUBE and ISIS to treat electron transport in materials using a Monte Carlo method in addition to the electron dynamics determined by the self-consistent electromagnetic, relativistic, particle-in-cell simulation codes that have been used extensively to model generation of electron beams and intense microwave production. Incorporation of a Monte Carlo method to model the transport of electrons in materials (conductors and dielectrics) in a particle-in-cell code represents a giant step toward realistic simulation of the physics of charged-particle beams. The basic Monte Carlo method used in the implementation includes both scattering of electrons by background atoms and energy degradation.

26423 (N—85-15655) Cosmic ray exposure and linear-energy-transfer evaluations for the COBE mission. Stassinopoulos, E.G.; Barth, J.M. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Nov 1984. 96p. (NASA-TM—87398). NTIS, PC A05/MF A01.

Magnetospherically attenuated, orbit integrated, surface incident cosmic ray fluxes of galactic origin were determined for the COBE mission. All heavy ions up to nickel (z-28) were considered in this evaluation. In order to provide worst case approximations, estimates were based on solar minimum conditions. Transport and material shielding calculations were then performed for these vehicle-encountered particles, for a simple spherical 3-D aluminum geometry, and the materially attenuated cosmic ray distributions emerging behind selected shield thicknesses were obtained. Finally, linear energy transfer (LET) spectra were evaluated for the energy spectra of each ion species and these were, in turn, integrated into the sum-total LET distribution contained herein. The results are presented in tabular and graphical form for eight different shield thicknesses from .01 to 10.0 gm/sq cm of aluminum. They show most conclusively, and not unexpectedly, that material shielding has virtually no effect on the final LET spectrum, at least not for aluminum shields.

26424 (ZfI-Mitt—90) 1983 publications of the Central Institute for Isotope and Radiation Research. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Jun 1984. 358p. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE85700613.

Most of the 1983 publications of the Zentralinstitut fuer Isotopen- und Strahlenforschung are presented as abstracts. Author and subject indexes are included.

26425 Porous media gas diffusivity from a free path distribution model. Tokunaga, T.K. (Earth Sciences Division, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Journal of Chemical Physics;* **82**: No. 11, 5298-5299(1 Jun 1985).

A model for the effective diffusivity in porous media is developed from simple considerations. This derivation is analogous to those used in force path models for electron and phonon diffusion in solids. (AIP).

26426 Transport behavior of dense protons in a slab. Lee, M.H.; Hong, J. (Univ. of Georgia, Athens). pp 549-553 of Electronic structure and properties of hydrogen in metals. Jena, P.; Satterthwaite, C.B. (eds.). New York, NY; Plenum Publishing Corporation (1983). Contract AS09-77ER01023.

Adsorbed hydrogen in a transition metal may be to a first order approximation regarded as a system of protons interacting pairwise via long-range forces. By limiting momentum transfers in proton-proton scattering to small wavevectors, the relaxation function for a many-proton system is obtained analytically by a method of recurrence relations recently developed by Lee. Other dynamical quantities including diffusivity are also obtained analytically.

6550 Medical Physics

26427 (DOE/ER/60142—2, pp 39-51) **Variance-covariance method: electric current measurements.** Lindborg, L.; Marino, S.; Rossi, H.H. Jul 1984. NTIS, PC A18/MF A01. File Number DE84014885.

In Radiation physics, biophysics and radiation biology. Progress report, December 1, 1983-November 30, 1984.

The experimental plan, the equipment, and some electronic tests for verifying the utility of the variance-covariance technique for microdosimetric applications in monoenergetic neutron beams are described. The technique depends on simultaneous measurements with two uncoupled detectors for making corrections due to fluctuations in beam intensity. Some measurements obtained in an x-ray beam are reported.

26428 (DOE/ER/60142—2, pp 52-61) **Microdosimetry of high intensity pulsed photon beams using a dual proportional counter and the covariance methods.** Kliauga, P.; Lindborg, L.; Rossi, H.H. Jul 1984. NTIS, PC A18/MF A01. File Number DE84014885.

In Radiation physics, biophysics and radiation biology. Progress report, December 1, 1983-November 30, 1984.

Pulse-measurement techniques in the determination of microdosimetric parameters at the Presbyterian Hospital Therapy Betatron are describe. The measurements make use of proportional counters sharing the same gas enclosure but separated by a tissue-equivalent plastic partition.

26429 (DOE/ER/60142—2, pp 62-81) **Microdosimetry of high energy charged particles.** Kliauga, P.; Rossi, H.H.; Braby, L.; Metting, N.; Howard, J. Jul 1984. NTIS, PC A18/MF A01. File Number DE84014885.

In Radiation physics, biophysics and radiation biology. Progress report, December 1, 1983-November 30, 1984.

On-going work in the development of facilities, equipment, and techniques for measuring microdosimetric distributions of high-energy charged particles at the Bevalac is described. Some recent results are presented and some planned studies are discussed.

26430 **(EHD—82-79) Occupational radiation exposures in Canada - 1980.** Ashmore, J.P.; Fujimoto, K.R.; Wilson, J.A.; Grogan, D. (Department of National Health and Welfare, Ottawa, Ontario (Canada). Radiation Protection Div.). Aug 1981. 81p. (In English and French). (DHM—82-79). NTIS (US Sales Only), PC A05/MF A01. File Number DE85700602.

This report is the third in a series of annual reports on Occupational Radiation Exposures in Canada. The data is derived from the Radiation Protection Bureau's National Dose Registry which includes dose records for radiation workers. The report presents average yearly doses by region and occupational category, dose distributions, and variation of average doses with time. Statistical data concerning investigations of high exposures reported by the National Dosimetry Services are included and individual cases are briefly summarized where the maximum permissible dose is exceeded. The decrease in the overall average doses established over the last 20 years appears to be changing. In some occupational categories a consistent upward trend is observed.

26431 **(INFO—0087) Dosimetry, measurement and properties of radon daughters and thoron daughters.** Phillips, C.R. (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Mar 1982. 200p. NTIS (US Sales Only), PC A09/MF A01. File Number DE85700603.

Various properties of radon and thoron daughter products are examined. Dosimeter methods and instrumentation (TLD and personal alpha dosimeters) are investigated as to performance under varying conditions such as humidity and pure or mixed atmospheric conditions. Optimized counting schemes are determined for the daughters of radon and thoron. An optimized counting scheme was experimentally examined under mine conditions. The optimization procedure takes into account the uncertainties associated with concentration, flow rate and radioactive decay. Measurements were made in two uranium mines at Elliot Lake, Ontario of the charged and unattached fractions of radon daughters in the mines. The physicochemical state of ^{218}Po in air was determined by measurement of rate of neutralization, diffusion coefficient and fraction born charge. Careful control of experimental conditions made it possible to obtain more precise and detailed quantitative data than previously possible.

26432 **(INFO—0090) Risk estimates for exposure to alpha emitters.** (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Jul 1982. 23p. (ACRP—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE85700597.

The primary scope of this report is to evaluate the risk of lung cancer from occupational exposure to short-lived daughters of radon and thoron. The Subcommittee on Risk Estimates considers that inhalation of radon and thoron daughters is the major radiation hazard from alpha radiation in uranium mining. The secondary scope of this report is the consideration of the applicability of the risk estimates derived from miners to the general public. The risk to members of the public from radium-226 in drinking water is also considered. Some research requirments are suggested.

26433 **(INFO—0091) Risks of low-LET radiation as given in BEIR-III and previous reports.** (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Jul 1982. 13p. (ACRP—2). NTIS (US Sales Only), PC A02/MF A01. File Number DE85700601.

This report presents the conclusions of a review of the report. The Effects on Populations of Exposure to Low Levels of Ionizing Radiation, BEIR-III, published by the U.S. National Academy of Sciences in 1980 and other related reports. The committee concludes that, in as far as the estimates of risk from low-LET radiation are concerned, the BEIR-III report does not provide any new data that might suggest that the present dose limits promulgated by the AECB should be changed.

26434 **(ORNL—6145) Collection and analysis of Health Physics Research Reactor operational and use data.** Sims, C.S. (Oak Ridge National Lab., TN (USA)). Apr 1985. Contract AC05-84OR21400. 28p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85010593.

The Health Physics Research Reactor (HPRR) is the primary research tool at the Dosimetry Applications Research (DOSAR) Facility. In addition to use by the DOSAR staff, the HPRR is used by a wide segment of the scientific community for a variety of experimental purposes. This report is a compilation and analysis of data concerning HPRR uses, users, and operations through the end of FY 1984. 17 refs., 12 tabs.,

26435 **(PUC-TN—21/82) Past and present of risk assessment for RA-226 releases.** Paschoa, A.S. (Pontificia Univ. Catolica do Rio de Janeiro (Brazil). Dept. de Fisica). Dec 1982. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700604.

Some of the new concepts introduced by ICRP 26 seem to be difficult to apply to the case of dose limits concerning the ^{226}Ra releases from the front end of the nuclear fuel cycle. Accordingly most national legislations have not been permeated yet by the ^{226}Ra dose limits based on such concepts. This work calls the attention on the one hand that a loose concept of acceptable risk is implicitly used in a dose limitation system for ^{226}Ra when such system is based on calculating the dose as a fraction of the (MPC) sub(w) introduced earlier by the ICRP 2, and on the other hand that the ALI currently recommended by the ICRP 30 should be used only in the framework of the recommendations published in the ICRP 26, which adopts a better defined concept of risk.

6560 Solid State Physics

REFER ALSO TO CITATION(S) 25792, 25801, 25856, 26309, 26310, 26339

26436 (AD-A—150075/0/XAB) Studies of silicon-refractory metal interfaces: photoemission study of interface formation and compound nucleation. Final report, 15 April 1983-30 September 1984. Weaver, J.H. (Minnesota Univ., Minneapolis (USA). Dept. of Chemical Engineering and Materials Science). 29 Oct 1984. 99p. NTIS, PC A05/MF A01.

The overall goal in this project was to examine the electronic and morphological interactions which occur at interfaces involving Si and metal overlayers. During the course of this project, we examined overlayers of Cr, Ti, Sm, Au, Ca, Ce, and Cu using photoelectron spectroscopy, Auger spectroscopy, and LEED. A new technique involving angle-resolved Auger profiling was developed to determine the atomic density profile for interfaces. Its utility was demonstrated through studies of Cu/Si, Au/Si, and Ce/Si. Exhaustive use of synchrotron radiation photoemission has lead to a detailed understanding of the electronic bonding of silicides and metal/silicon interfaces. Collaborative studies with theorists gave rise to modeling of interfaces and calculation of electronic energy states for ordered silicides.

26437 (CONF-8409228—1) Microscopic structure of two-dimensional electron glass. Kalia, R.K.; Vashishta, P. (Argonne National Lab., IL (USA)). Sep 1984. Contract W-31-109-ENG-38. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010265.

From Midwest solid state theory symposium; Minneapolis, MN, USA (6 Sep 1984).

Structural properties of a classical two-dimensional system of electrons on a corrugated surface are investigated by the molecular dynamics method. Rapid quenching of the electron liquid leads to glass formation. Direct evidence for two-level states is obtained in the electron glass and the transitions between them are found to arise from displacements of a small number of spatially localized electrons.

26438 (LA-UR—85-1223) Quasiparticle excitations in valence-fluctuation materials: effects of band structure and crystal fields. Brandow, B.H. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 21p. (CONF-8504115—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010783.

From 5. international conference on crystalline field effects in f-electron systems: ICCF5; Sendai, Japan (15 Apr 1985).

Evidence is now quite strong that the elementary hybridization model is the correct way to understand the lattice-coherent Fermi liquid regime at very low temperatures. Many-body theory leads to significant renormalizations of the input parameters, and many of the band-theoretic channels for hybridization are suppressed by the combined effects of Hund's-rule coupling, crystal-field splitting, and the f-f Coulomb repulsion U. Some exploratory calculations based on this picture are described, and some inferences are drawn about the band structures of several heavy-fermion materials. These inferences can and should be tested by suitably modified band-theoretic calculations. We find evidence for a significant Baber-scattering contribution in the very-low-temperature resistivity. A new mechanism is proposed for crossover from the coherent Fermi-liquid regime to the incoherent dense-Kondo regime. 28 refs.

26439 Gap-edge states, broken particle-hole symmetry, and kink-antikink asymmetry in bounded Peierls systems. Jacobs, A.E. (Department of Physics and Scarborough College, University of Toronto, Toronto, Ontario, Canada M5S1A7 and Department of Physics, Building 510A, Brookhaven National Laboratory, Upton, New York 11973). *Physical Review [Section] B: Condensed Matter;* **31**: No. 10, 6695-6708(15 May 1985). Contract AC02-76CH00016.

The continuum model for a Peierls system with a half-filled band is solved for a finite chain, the electron wave functions being required to vanish at the ends of the chain; results different from those found using periodic or antiperiodic boundary conditions are obtained. For the homogeneously dimerized state, the single kink (or antikink) state, and the single polaron state, there can be an electronic state at either the upper or the lower edge of the gap, without a corresponding state at the other edge. In agreement with the numerical result of Su on the Su-Schrieffer-Heeger model, the ground state of a chain with equal, odd numbers of electrons and ions contains a kink (or an antikink); also, for an odd chain, the kink energy differs from the antikink energy, neither value being the $2\Delta_0/\pi$ found in previous work on the continuum model. The energy required to introduce a kink and an antikink is, however, $4\Delta_0/\pi$, as in previous work. The origin of the midgap state obtained upon the introduction of a kink (or an antikink) is simply explained in terms of the gap-edge states.

26440 Oguchi upper bound on the magnetization for ferromagnetic Ising models. Siu, B. (California Institute of Technology, Pasadena, California 91125). *Journal of Statistical Physics;* **38**: No. 2, 519-572(Feb 1985).

The Oguchi approximation is shown to give an upper bound on the magnetization for spin-1/2 Ising models with arbitrary ferromagnetic pair couplings. The resulting bound on the critical temperature is shown to better couplings. The resulting bound on the critical temperature is shown to better than the mean field bound. For ferromagnetic spin-1/2 models where the three-body approximation predicts a unique magnetization, this too is shown to give a magnetization bound and an even better bound on the critical temperature.

6561 Superconductivity

REFER ALSO TO CITATION(S) 25840

6570 Theoretical Physics

REFER ALSO TO CITATION(S) 26325, 26357, 26419, 26440, 26455

26441 (AD-A—149592/8/XAB) Stable measures and processes in statistical physics. Technical report. Weron, A.; Weron, K. (North Carolina Univ., Chapel Hill (USA). Center for Stochastic Precesses). Nov 1984. 15p. NTIS, PC A02/MF A01.

It is shown how alpha-stable distributions arise in statistical physics. A probabilistic proof of Khalfin's formula for decaying quantum systems is given. Also ergodic properties of symmetric alpha-stable flows in classical statistical mechanics is discussed.

26442 (LA-UR—85-1173) MCNP variance reduction overview. Hendricks, J.S.; Booth, T.E. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 12p. (CONF-8504110—12). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010765.

From Joint Los Alamos/CEA meeting on Monte Carlo methods; Cadarache, France (22 Apr 1985).

The MCNP code is rich in variance reduction features. Standard variance reduction methods found in most Monte Carlo codes are available as well as a number of methods unique to MCNP. We discuss the variance reduction features presently in MCNP as well as new ones under study for possible inclusion in future versions of the code.

26443 (LA-UR—85-1267) Monte Carlo simulations of fermion systems: the determinant method. Gubernatis, J.E. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 10p. (CONF-8504110—15). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010708.

From Joint Los Alamos/CEA meeting on Monte Carlo methods; Cadarache, France (22 Apr 1985).

Described are the details for performing Monte Carlo simulations on systems of fermions at finite temperatures by use of a technique called the Determinant Method. This method is based on a functional integral formulation of the fermion problem [Blankenbecler et al., Phys. Rev D 24, 2278 (1981)] in which the quartic fermion-fermion interactions that exist for certain models are transformed into bilinear ones by the introduction [J. Hirsch, Phys. Rev.

B 28, 4059 (1983)] of Ising-like variables and an additional finite dimension. It is on the transformed problem the Monte Carlo simulations are performed. A brief summary of research on two such model problems, the spinless fermion lattice gas and the Anderson impurity problem, is also given.

26444 Critical-point conditions for classical polydisperse fluids. Johnson, K.A.; Jonah, D.A.; Kincaid, J.M.; Morrison, G. (Thermophysics Division, National Bureau of Standards, Gaithersburg, Maryland 20899). *Journal of Chemical Physics;* **82**: No. 11, 5178-5183(1 Jun 1985).

The critical-point conditions for a polydisperse mixture are shown to be equivalent to those for the existence of nontrivial solutions to two homogeneous integral equations of the Fredholm type. This mathematically rigorous treatment is not dependent on the form of any particular model free energy and hence shows that there is no formal distinction between the critical-point conditions of a polydisperse fluid and those conditions derived by Gibbs for the critical point of a mixture with a finite number of components. Using the method of Fredholm, we express the critical-point conditions in terms of the zeros of two absolutely convergent expansions, and demonstrate how the expansions may be used to determine the shifts in critical density and temperature caused by changes in the composition of the fluid.

26445 Phase-space eikonal method for treating wave equations. McDonald, S.W. (Physics Department and Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Physical Review Letters;* **54**: No. 12, 1211-1214(25 Mar 1985). Contract AC03-76SF00098.

We present a new method for treating classical (or quantal) wave equations in the short-wavelength (semiclassical) regime, based on a description of the wave in the ray phase space. The coherent-state representation is defined, and the equation which it obeys is given and solved under assumptions similar to those of conventional eikonal theory. As indicated by an example, the result is a smooth distribution on phase space which, when "projected" onto configuration space, yields a wave field with no caustic singularities.

26446 Augmented Langevin approach to fluctuations in nonlinear irrversible proceses. Ramshaw, J.D. (Theoretical Division, University of California, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Statistical Physics;* **38**: No. 2, 669-680(Feb 1985).

A Fokker-Planck equation derived from statistical mechanics by M. S. Green [J. Chem. Phys. 20:1281 (1952)] has been used by Grabert et al. [Phys. Rev. A 21:2136 (1980)] to study fluctuations in nonlinear irreversible processes. These authors remarked that a phenomenological Langevin approach would not have given the correct reversible part of the Fokker—Planck drift flux, from which they concluded that the Langevin approach is untrustworthy for systems with partly reversible fluxes. Here it is shown that a simple modification of the Langevin approach leads to precisely the same covariant Fokker—Planck equation as that of Grabert et al., including the reversible drift terms. The modification consists of augmenting the usual nonlinear Langevin equation by adding to the deterministic flow a correction term which vanishes in the limit of zero fluctuations, and which is self-consistently determined from the assumed form of the equilibrium distribution by imposing the usual potential conditions. This development provides a simple phenomenological route to the Fokker—Planck equation of Green, which has previously appeared to require a more microscopic treatment. It also extends the applicability of the Langevin approach to fluctuations in a wider class of nonlinear systems.

26447 Spherical reference systems for nonspherical hard interactions. Williams, G.O.; Lebowitz, J.L.; Percus, J.K. (New York Univ., NY). *Journal of Physical Chemistry;* **88**: No. 26, 6488-6491(20 Dec 1984). Contract AC02-76ER03077.

Results are presented on three complex systems of hard molecules: linear triatomics, heteronuclear dumbbells, and two-component mixtures of dumbbells. In addition to studying the equation of state generated by the median potential, the Barker-Henderson reference system is also investigated and seen to give results nearly indistinguishable from those obtained from the median system. Both reference systems continue to reproduce the bulk thermodynamics of the true systems moderately well. Both reference potentials are found to be approximately additive when applied to mixtures. These results continue to suggest that either of these two reference systems may form the basis of a successful perturbation theory for fluids of nonspherical molecules. 15 references, 5 figures, 9 tables.

26448 Thermodynamics of interfacial oscillations in two-dimensional systems. Percus, J.K. (New York Univ., NY). *Journal of Physical Chemistry;* **88**: No. 26, 6499-6507(20 Dec 1984). Contract AC02-76ER03077.

The quiescent two-phase interface density profile and its capillary wave broadening are obtained heuristically. In two-dimensional space, the drumhead model in an arbitrary external field is transformed into a pair of Bloch equations and solved in special cases. It is extended to encompass a fixed liquid volume change. The original model is then solved completely and expressed as a free energy density functional, which is likewise extended. Finally, the genesis of the singular structure of the free energy is discussed. 14 references, 1 figure.

26449 Distribution functions in quantum optics. O'connell, R.F. (Louisiana State Univ., Baton Rouge). *Lecture Notes in Physics;* **182**: 238-248(1983). Contract AS05-79ER10459.

Perhaps the simplest way of including quantum mechanics, in various problems in quantum optics, is by use of the classical-quantum-correspondence method, by means of which one replaces quantum-mechanical operators by complex numbers. This is carried out by means of quasi-classical distribution functions and here the question of which is the best choice of function from the large selection available is addressed. Whereas Glauber's P (α) distribution is useful in many applications, it does not exist as a well-behaved function in many others. In such cases, a more useful function is the generalized P-representation of Drummond and Gardiner. However, based on simplicity and overall applicability, it is concluded that Wigner's function also has a claim to be the optimum choice. 33 references.

26450 Computer simulation of phase transitions in classical and quantum systems. Alder, B.J.; Ceperley, D.M.; Pollock, E.L. (Univ. of California, Livermore). *International Journal of Quantum Chemistry, Symposium;* No. 16, 49-61(1982). (CONF-820330—). Contract W-7405-ENG-48.

From International symposium on quantum chemistry, theory of condensed matter, and propagator methods in the quantum theory of matter; Flagler Beach, FL, USA (1 Mar 1982).

The melting transition of classical hard disks is reviewed, emphasizing evidence from computer simulation for the order of the transition, mechanism of melting, and convergence of the virial expansion. Next, the graph theoretical treatment of a dilute mixture of electrolytes consisting of stripped iron ions in a hydrogen plasma is examined for fluid phase separation at the center of the sun. For quantum many-body systems a stochastic numerical scheme is outlined and applied to the Fermi electron gas at 0 K to locate the melting transition and the region of stability of the ferromagnetic fluid phase. Finite temperature results for the electron gas are used to estimate the region of convergence of the expansion away from the classical limit. Results for the superfluid transition of helium are compared to those of the ideal gas. Preliminary results leading to a prediction for the molecular to metal transition in hydrogen are also presented. 18 references, 7 figures.

26451 Analytic structure and integrability of dynamical systems. Tabor, M. (Center for Studies of Nonlinear Dynamics, La Jolla, CA). *International Journal of Quantum Chemistry, Symposium;* No. 16, 167-181(1982). (CONF-820330—).

From International symposium on quantum chemistry, theory of condensed matter, and propagator methods in the quantum theory of matter; Flagler Beach, FL, USA (1 Mar 1982).

The solutions to the equations of motion of certain dynamical systems are investigated as a function of complex time. The use of the Painleve property, i.e., the property that the only movable

singularities exhibited by the solution are poles, enables a prediction of system parameter values for which the system is integrable. The method is illustrated by a study of the Henon-Heiles system. Extension of the analysis to movable branch points reveals at least one more integrable case. Further changes in analytic structure correlate with the onset of widespread chaos. 27 references, 3 figures, 1 table.

6580 Mathematical Physics

REFER ALSO TO CITATION(S) 26323

26452 (ANL—84-73) Spectral theory of Sturm-Liouville differential operators: proceedings of the 1984 workshop. Kaper, H.G.; Zettl, A. (eds.). (Argonne National Lab., IL (USA)). Dec 1984. Contract W-31-109-ENG-38. 208p. (CONF-8405303—). NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE85009893.

From Workshop on spectral theory of Sturm-Liouville differential operators; Argonne, IL, USA (14 May 1984).

This report contains the proceedings of the workshop which was held at Argonne during the period May 14 through June 15, 1984. The report contains 22 articles, authored or co-authored by the participants in the workshop. Topics covered at the workshop included the asymptotics of eigenvalues and eigenfunctions; qualitative and quantitative aspects of Sturm-Liouville eigenvalue problems with discrete and continuous spectra; polar, indefinite, and nonselfadjoint Sturm-Liouville eigenvalue problems; and systems of differential equations of Sturm-Liouville type.

26453 (LA-UR—85-1055) Noise-sustained structure, intermittency, and the Ginzburg-Landau equation. Deissler, R.J. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 9p. (CONF-850165—3). NTIS, PC A02/MF A01. File Number DE85009626.

From Conference on solitons and coherent structures; Santa Barbara, CA, USA (11 Jan 1985).

The time-dependent generalized Ginzburg-Landau equation is a partial differential equation that is related to many physical systems. In the stationary (i.e., laboratory) frame of reference the equation is: Partial psi/partial t = a psi - ν (partial psi/partial x) + b (partial squared x/partial x^2) - c (psi absolute)^2 psi where the dependent variable psi is in general complex; a, b, and c are constants which are in general complex; and ν is the group velocity. Consider a small initial localized perturbation about the equilibrium state psi=O. A linear stability analysis reveals that there are three types of behavior which this perturbation can undergo. (1) The perturbation will be damped in any frame of reference. This behavior corresponds to the system being absolutely stable. (2) The perturbation will grow and spread such that the edges of the pertubation move in opposite directions. This behavior corresponds to the system being absolutely unstable. The perturbation will be damped at any given stationary point but a frame of reference may be found in which the perturbation is growing. In other words, even though the perturbation is growing and spreading, it is moving at a sufficiently large velocity such that both edges of the perturbation are moving in the same direction. Thus the system behind the perturbation returns to its undisturbaed state. This behavior corresponds to the system being spatially unstable (i.e., convectively unstable).

26454 (LA-UR—85-1467) Exact invariants in resonance form for time-dependent potentials. Lewis, H.R.; Goedert, J. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 5p. (CONF-850165—4). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010733.

From Conference on solitons and coherent structures; Santa Barbara, CA, USA (11 Jan 1985).

We have developed a framework for the momentum-resonance formulation of Lewis and Leach that casts new light into the nature of exact, explicitly time-dependent invariants for one-dimensional time-dependent potentials and produces additional examples of such invariants. The momentum-resonance formulation postulates that the invariant be a rational function of momentum with simple poles, which are called momentum resonances. We have shown that an invariant of resonance type can be written as a functional of the potential in terms of the solution of a system of linear algebraic equations; and we have obtained a single necessary and sufficient condition for a potential to admit an invariant of resonance type. These results were obtained by reformulating the problem in terms of a set of discrete moments that satisfy two separate recursion formulae. Invariants for new time-dependent potentials were obtained and previously known invariants were recovered.

26455 Curvature and solidification. Chorin, A.J. (Department of Mathematics and Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Journal of Computational Physics;* **57**: No. 3, 472-490(Feb 1985). Contract AC03-76SF00098.

A method is presented for finding the osculating circle, and thus the curvature and the normal, of a curve defined by an array of partial volumes. This method is applied, within the framework of an enthalpy formulation, to the solutions of model equations that describe the motion of a front separating ice and supercooled water. For short to moderate times the numerical results agree well with available theory; at longer times a morphological oscillation is observed. Such an oscillation was seen in earlier calculations but is not predicted by linearized stability theory. Some speculations regarding its origin are offered.

6590 Communication, Education, History, And Philosophy

REFER ALSO TO CITATION(S) 26362, 26365

26456 (LA—10311-MS) "Where is everybody." An account of Fermi's question. Jones, E.M. (Los Alamos National Lab., NM (USA)). Mar 1985. Contract W-7405-ENG-36. 13p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85011898.

Fermi's famous question, now central to debates about the prevalence of extraterrestrial civilizations, arose during a luncheon conversation with Emil Konopinski, Edward Teller, and Herbert York in the summer of 1950. Fermi's companions on that day have provided accounts of the incident.

70 FUSION ENERGY

7001 Plasma Research

REFER ALSO TO CITATION(S) 26366

26457 (CONF-850310—81) Simulating the effects of plasma disruption with a 1 MA current pulse in a coaxial test fixture. Praeg, W.F. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010491.

From 6. topical meeting on the technology of fusion energy; San Francisco, CA, USA (3 Mar 1985).

A test fixture for simulating plasma disruptions, comprising two coaxial cylinders, has been designed for use with Argonne's electromagnetic test facility FELIX. A pulsed power supply drives a half cycle sine wave current of 10^6 A through the test fixture generating fields of < 2 T and field changes of < 1250 T s^{-1}. The coaxial structure is 140 cm long, has an outer cylinder with an OD of 78 cm and an inner cylinder with an OD of 8.3 cm. It is surrounded by the FELIX solenoid field of 1 T. This proposed upgrade of the FELIX facility should be useful for testing the effect of plasma disruption on First Wall-Blanket-Shield (FWBS) structures; a future upgrade of the solenoid field to 4 T will allow to simulate reactor conditions even better.

26458 (DOE/DP/40152—T7) Absolutely unstable two-plasmon decay in two dimensions. Powers, L.V. (KMS Fusion, Inc., Ann Arbor, MI (USA)). Feb 1985. Contract AC08-82DP40152. 15p. (KMSF-U—1567). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85008157.

The purpose of the work reported herein is to examine absolute modes of the TPD instability in two dimensions in an infinite homogeneous plasma. Briggs has shown that the condition for abso-

lute instability in this case is the existence of a solution of the coupled mode dispersion relation. Analytic solutions for eigenmodes in inhomogeneous plasma have been obtained as expansions about the solutions which satisfy the Briggs criteria in one dimension; hence finding TPD solutions which satisfy the Briggs criteria in two dimensions may give a basis for identifying two-dimensional eigenvalues in the inhomogeneous case as well.

26459 **(DOE/ER/10749—T1) Theoretical study of electron capture in ion-ion and ion-atom collisions. Final report, September 1, 1980-January 31, 1985.** Lieber, M.; Chan, F.T. (Arkansas Univ., Fayetteville (USA). Dept. of Physics). Mar 1985. Contract AS05-80ER10749. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85011154.

A list of publications as a result of this contract is given. Research summaries of eikonal calculations of the collisions are presented. (MOW)

26460 **(GA-A—17969) Heating of electrons in a high density tokamak by a micro-wave near second harmonic frequency.** Matsuda, K. (GA Technologies, Inc., San Diego, CA (USA)). Apr 1985. Contract AT03-84ER53158. 6p. (CONF-8505130—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010682.

From 6. topical conference on radio frequency plasma heating; Pine Mountain, GA, USA (13 May 1985).

Detailed numerical solutions for obliquely propagating electromagnetic waves near the second harmonic electron cyclotron frequency have been obtained for a plasma of density around the cutoff density of the ordinary mode (O-mode). In a tokamak plasma satisfying a relatively loose condition, a launched O-mode of moderate n/sub parallel/ pass through locations where several branches of electromagnetic hot plasma modes with large right hand components may exist; one of them is the branch of the extraordinary mode (X-mode) and others are new modes. Possibilities of electron heating through mode conversions to those modes are discussed.

26461 **(GA-A—17992) Runaway electrons and plasma turbulence in current ramping by lower hybrid waves in tokamak plasmas.** Liu, C.S.; Chan, V.S.; Lee, Y.C. (GA Technologies, Inc., San Diego, CA (USA); Maryland Univ., College Park (USA)). May 1985. Contract AT03-84ER53158. 5p. (CONF-8505130—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85011390.

From 6. topical conference on radio frequency plasma heating; Pine Mountain, GA, USA (13 May 1985).

The role of runaway electrons in current ramping by lower hybrid waves is discussed. The back emf induced by current ramping using lower hybrid waves produces runaway electrons at such a rate that the rate of change of the current carried by runaways can completely compensate the rf current ramp rate if runaways are well-confined. However, runaway electrons can also destabilize the oblique plasma waves due to their anisotropy. The resulting turbulence can greatly reduce the run-away production rate, enabling the current ramping rate to exceed the above limit.

26462 **(LA-UR—85-1119) Caviton collapse of SRS by SBS.** Aldrich, C.; Bezzerides, B.; DuBois, D.F.; Rose, H. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 15p. (CONF-8409229—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85009605.

From CECAM workshop transport, interactions and instabilities in laser-plasmas; Orsay, France (24 Sep 1984).

Particle simulations are performed to show that the ion waves resulting from Stimulated Brillouin Scatter (SBS) can trigger the collapse of the plasma waves excited by Stimulated Raman Scatter (SRS). We discuss the effect of this collapse mechanism on the hot-electron spectrum produced by the electrostatic waves. A fluid model for the coupling of the ion fluctuations to the plasma waves is formulated and we discuss the necessary condition on the SBS to induce collapse of the plasma waves produced by SRS.

26463 **(LA-UR—85-1314) Time-implicit Monte-Carlo collision algorithm for particle-in-cell electron transport models.** Cranfill, C.W.; Brackbill, J.U.; Goldman, S.R. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 14p. (CONF-8504110—9). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010758.

From Joint Los Alamos/CEA meeting on Monte Carlo methods; Cadarache, France (22 Apr 1985).

A time-implicit Monte-Carlo collision algorithm has been developed to allow particle-in-cell electron transport models to be applied to arbitrarily collisional systems. The algorithm is formulated for electrons moving in response to electric and magnetic accelerations and subject to collisional drag and scattering due to a background plasma. The correct fluid or streaming transport results are obtained in the respective limits of strongly- or weakly-collisional systems, and reasonable behavior is produced even for time steps greatly exceeding the magnetic-gyration and collisional-scattering times.

26464 **(LA-UR—85-1320) Monte-Carlo treatment of nonlinear collisional effects in charged-particle transport.** Weiss, D.L.; Witte, K.H.; Sheppard, M.G.; Oliphant, T.A. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 16p. (CONF-8504110—8). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010755.

From Joint Los Alamos/CEA meeting on Monte Carlo methods; Cadarache, France (22 Apr 1985).

The effects of two-body coulomb collisions of the simulation particles against a background material are often treated by a Monte-Carlo collisional process in which the collision probability is determined by a Fokker-Planck treatment. This procedure is nonlinear if the properties of the background material are allowed to change as a result of the scattering of the simulation particles. A more completely, nonlinear problem is obtained if the simulation particles themselves form all or part of the background distribution. A new method is presented here for doing this, and examples will be discussed that illustrate the power of the technique.

26465 **(SAIC—85/1675-PRI-90) Toroidal viscosity and ambipolarity in the neoclassical transport theory of axisymmetric tori.** Catto, P.J. (Science Applications International Corp., Boulder, CO (USA). Plasma Research Inst.). Apr 1985. Contract AC03-76ET53057. 54p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85010622.

To self-consistently evaluate both the toroidal rotation and the radial electric field in a tokamak the two distinct constraints of toroidal momentum conservation and ambipolarity must be invoked. A gyrokinetic derivation of the neoclassical transport equations which permits large toroidal rotations and poloidal precessions is employed to obtain an explicit form for the toroidal viscosity which displays its relation to ambipolarity. In general, it is also found necessary to retain the poloidal variations in the electrostatic potential and density. A tokamak plateau regime calculation is performed using the general formulation to illustrate the procedures.

26466 **(UWFDM—587) Ballooning instabilities on a magnetic separatrix.** Qu, W.X.; Callen, J.D. (Wisconsin Univ., Madison (USA). Dept. of Nuclear Engineering). Sep 1984. Contract AC02-80ER53104. 25p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010855.

The stability of plasmas to localized ballooning modes on a magnetic separatrix (such as occurs with divertor tokamak configurations) is considered. The ideal MHD ballooning eigenmode equation is first derived for a general Clebsch representation and then specialized to particular divertor magnetic flux surface representations. A combination of analytic and numerical calculations is used to show that ballooning instability occurs for $dp/dr > (B^2/2\mu_0)R_0/l/\text{sub } c/^2$ where the connection length l/sub c/ is found to be approximately the distance between X-points on the separatrix. The possible role of these instabilities in tokamak H-mode edge fluctuations (H/sub α/ spikes, quasi-coherent fluctuations) is also discussed.

26467 Methods for producing ultrahigh magnetic fields. Felber, F.S.; Liberman, M.A.; Velikovich, A.L. (Jaycor, P.O. Box 85154, San Diego, California 92138). *Applied Physics Letters;* **46**: No. 11, 1042-1044(1 Jun 1985).

A general class of methods is suggested for producing controlled magnetic fields up to the order of 100 MG. The methods involve radially imploding plasmas in which longitudinal magnetic fields have been entrained. Specific methods of implosion suggested are (a) gas-puff Z pinch and (b) ablative implosion of a liner by a laser. Applications include reducing fusion ignition thresholds, producing beams of gamma radiation, accelerating particles, and producing high-energy densities under controlled conditions.

26468 Chaotic behavior of thermal excitations in edge plasmas. Weiland, J.; Mondt, J.P. (Institute for Electromagnetic Field Theory, Chalmers University of Technology, S-412 96 Goeteborg, Sweden). *Physics of Fluids;* **28**: No. 6, 1735-1738(Jun 1985).

It is found that an electromagnetic analog of the current convective instability in the nonlinear regime may develop into a chaotic system. Comparison is made with the corresponding electrostatic strongly nonlinear case which may show chaotic behavior of the Lorenz type, and the nonlinear cascade properties are discussed.

26469 Wave heating at the third harmonic of the ion-cyclotron frequency. Swanson, D.G. (Department of Physics, Auburn University, Alabama 36849). *Physics of Fluids;* **28**: No. 6, 1800-1809(Jun 1985). Contract AS05-82ER53134.

For heating of fusion reactors, heating at the third harmonic of deuterium is shown to be an attractive possibility since absorption is still strong and the plasma core is accessible. The higher frequency also makes the application of waveguide launchers more attractive because of the smaller size. The calculation model is a deuterium—tritium plasma with a small α component. The dispersion relation leads to a sixth-order mode conversion equation solved by the Green function formalism which converts it to an integral equation. Numerical studies for the effects of absorption find the analytic transmission coefficient to be exact, and empirical formulas are given for the reflection and conversion coefficients and the power balance between the deuterium and helium. Conservation of energy is also discussed in some detail.

26470 Quasi-steady-state toroidal discharges. Bevir, M.K.; Gimblett, C.G.; Miller, G. (Euratom/UKAEA Fusion Association, Culham Laboratory, Abingdon, Oxon, OX14 3DB, England). *Physics of Fluids;* **28**: No. 6, 1826-1836(Jun 1985).

A method for maintaining toroidal current in toroidal plasmas is discussed. The method requires application of suitably phased oscillating toroidal and poloidal voltages to the plasma resulting in a magnetic field configuration with small oscillations around some mean state. In such quasi-steady states the usual v sec limitation on discharge duration is eliminated. The current drive effect is caused by a nonlinear interaction between the toroidal and poloidal circuits that can be understood in general terms from symmetry considerations. Specific calculations of the effect are made using two models: (1) a zero-dimensional relaxation model, relevant to the reversed-field pinch, and (2) a one-dimensional resistive diffusion model (assuming slab geometry). The results for the relaxation model indicate a useful current drive effect that may be of importance for the reversed-field-pinch program.

26471 Confinement effects of electron heating in the thermal barrier of a tandem mirror. Carrera, R.; Catto, P.J. (Science Applications International Corporation, Plasma Research Institute, 934 Pearl Street, Boulder, Colorado 80302). *Physics of Fluids;* **28**: No. 6, 1906-1916(Jun 1985).

In order to assess the possible benefit of applying low levels of electron-cyclotron resonance heating (ECRH) in the thermal barrier region of a tandem mirror a simple thermal barrier model is considered. The collisional fluxes of the hot, barrier electrons diffusing into the central cell and plug, the warm electrons escaping from the plug, and the cooler, central-cell electrons passing over the thermal barrier and becoming trapped, are evaluated.

26472 Observation of coherent radiation at the electron plasma frequency from a tokamak. Gandy, R.F.; Yates, D.H. (Plasma Fusion Center, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Physics of Fluids;* **28**: No. 6, 1877-1880(Jun 1985). Contract AC02-78ET51013.

High-resolution spectral measurements have been made of the fluctuating electron plasma frequency (ω/sub p/e) radiation from Alcator C. Results of spectral measurements with a dispersive delay line indicate that one or more very narrow, irregularly spaced components are present in each "burst" of ω/sub p/e emission. A direct-sampling technique with an instrumental resolution of 200 kHz has been used to resolve the individual features of a burst. Features as narrow as 350 kHz have been observed ($\Delta f/f = 6 \times 10^{-6}$). This result suggests that a highly coherent process is responsible for the emission.

26473 Finite-Larmor-radius-corrected collision operator: A new approach to solving the kinetic equation. Auerbach, S.P. (Lawrence Livermore National Laboratory, University of California, Livermore, California 94550). *Physics of Fluids;* **28**: No. 6, 1688-1694(Jun 1985). Contract W-7405-ENG-48.

The kinetic equation for a magnetized plasma is usually treated by transforming the kinetic operator partial/partialt+v x del/sub x/+(e/m)(E+v x B/c) x del/sub v/ to guiding-center variables, while evaluating the collision operator at the particle position. This introduces apparent nonlocality into a local equation. A method is presented for transforming the kinetic equation into a local equation, i.e., an equation in which the kinetic operator and the collision operator are evaluated at the same point (the guiding-center position). The collision operator is transformed thereby into a new operator, called the FLR-corrected collision operator, which is a power series in the displacement between a particle and its guiding center. This transformation to a local equation, plus the use of the guiding-center distribution function, make the method significantly more efficient than standard techniques. The method is illustrated by a calculation of transport caused by ion—neutral collisions. The technique is sufficiently general that it could be applied in a variety of contexts, for example, neoclassical transport, or the effect of collisions on a wave.

26474 Differential forms and canonical variables for drift motion in toroidal geometry. Littlejohn, R.G. (Department of Physics, University of California, Berkeley, California 94720). *Physics of Fluids;* **28**: No. 6, 2015-2016(Jun 1985). Contract AC03-76SF00098.

Differential forms provide a simple and powerful computational tool for finding canonical variables for drift motion in toroidal geometry. The method is easily applied to relativistic drift motion.

26475 Half-coalescence ideal magnetohydrodynamic instability of the q = 1 magnetic island in tokamaks. Lee, J.K.; Chu, M.S.; Liu, C.S.; Drake, J.F. (GA Technologies Inc., San Diego, California 92138). *Physics of Fluids;* **28**: No. 6, 1585-1588(Jun 1985). Contract AT03-84ER53158.

The ideal magnetohydrodynamic instability of a symmetric q = 1 magnetic island is studied by using an initial value method for a pressureless cylindrical tokamak plasma. It is shown that the island is unstable to a half-coalescence motion which destroys the up—down symmetry of the magnetic configuration. The mode characteristics are qualitatively similar to those predicted by Bussac et al. [Phys. Lett. 105A, 51 (1984)].

26476 Trapped particle instability induced by axial shear in E x B velocity. Byers, J.A.; Cohen, R.H. (Lawrence Livermore National Laboratory, University of California, P. O. Box 5511, Livermore, California 94550). *Physics of Fluids;* **28**: No. 6, 1589-1591(Jun 1985). Contract W-7405-ENG-48.

A new nonflute form of the E x B shear-driven trapped particle mode is obtained for a simplified square well equilibrium model of a tandem mirror. The mode is more unstable for a larger passing density in contrast to the curvature-driven trapped particle mode. Under some circumstances this mode can avoid the stabiliz-

ing effect of strong anchor curvature by isolating to the center cell and can do so without paying the magnetohydrodynamic (MHD) penalty for bending the field lines, thus requiring a large center cell ion gyroradius for stabilization.

26477 **Kinetic and fluid approaches to low-frequency magnetohydrodynamics: A comparison.** Hassam, A.B. (Laboratory for Plasma and Fusion Energy Studies, University of Maryland, College Park, Maryland 20742). *Physics of Fluids;* **28**: No. 6, 1684-1687(Jun 1985).

Kinetic and fluid approaches to the problem of low-frequency magnetohydrodynamic flute stability of plasmas where the equilibrium electron gradient-B drift is larger than the curvature drift are compared. It is shown that the two approaches are practically identical for frequencies below the curvature drift frequency. The identical nature of the approaches has to do with the fact that the large gradient-B drift has the primary effect of maintaining the electron temperature constant along its path; since this fact is independent of the collision frequency, the same equation of state applies to both approaches.

26478 **Finite beta stabilization of the kinetic ion mixing mode.** Pu, Y.; Migliuolo, S. (Physics Department, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Physics of Fluids;* **28**: No. 6, 1722-1726(Jun 1985). Contract AC02-78ET51013.

The full finite-β local dispersion relation of the ion mixing mode is derived and analyzed, using kinetic theory. The physical mechanism of finite-β stabilization of a single (i.e., fixed wavenumber, k/sub z/r/sub n/ and b/sub i/ constant) ion mixing mode is discussed. The distortion of the resonant region, in velocity space (by delB drifts) and the coupling to the shear Alfven wave are shown to be the important stabilization mechanisms. It is found that high values of β ($\beta > \beta$/sub c/, where β/sub c/ = 0.1→1.0, for relevant parameters) are necessary for stabilization.

26479 **Dissipative instabilities at the edge of reversed-field pinches driven by a combination of plasma gradients and a parallel current.** Mondt, J.P.; Goedert, J. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physics of Fluids;* **28**: No. 6, 1816-1825(Jun 1985).

Stability in the edge region of reversed-field pinches is analyzed within the context of a two-fluid model. Two major sources of instability are identified: in combination with a parallel electric field, either an electron temperature gradient and/or a density gradient leads to rapid growth (of several to many Ohmic heating rates) over a region of several millimeters around the mode-rational surfaces in the edge region. The basic signature of both instabilities is electrostatic. In the case of the density gradient mode, it relies on the effects of electron compressibility, whereas the temperature gradient mode can be identified as the current-convective instability by taking the limit of zero density gradient, thermal force, and electron compressibility. The possibility of enhanced particle loss and thermal convection as a nonlinear consequence of the instability is indicated. A criterion for the overlap of the linearly unstable regions in the edge of reversed-field pinches is obtained.

26480 **Quasilinear theory of the ponderomotive force: Induced stability and transport in axisymmetric mirrors.** D'Ippolito, D.A.; Myra, J.R. (Plasma Research Institute, Science Applications International Corporation, 934 Pearl Street, Boulder, Colorado 80302). *Physics of Fluids;* **28**: No. 6, 1895-1905(Jun 1985). Contract AC03-76ET53057.

A kinetic theory of the ponderomotive force density produced by an electromagnetic cyclotron wave is developed within the quasilinear approximation. The theory is applied to identify the effects of the rf-plasma interaction in equilibrium, stability and transport in paraxial, axisymmetric mirror geometry. The force caused by nonresonant particles is shown to modify the usual magnetohydrodynamic interchange stability drive, and the corresponding arbitrary-m ballooning equation is derived. Resonant particle contributions to the force are shown to arise from the absorption of photon momentum and spin. This effect produces a radial particle flux, modifies the radial ambipolar potential profile, and couples transport and stability.

26481 **Skin current driven microinstabilities in a magnetized plasma.** Farengo, R.; Lee, Y.; Guzdar, P.N. (Laboratory for Plasma and Fusion Energy Studies, University of Maryland, College Park, Maryland 20742). *Physics of Fluids;* **28**: No. 6, 1739-1753(Jun 1985).

Currents flowing parallel to a magnetic field with a gradient in the perpendicular direction are present in many interesting situations in plasma physics. In Ohmic heated experiments the current gradient is accompanied by a temperature gradient, and it is shown that both gradients can drive unstable, low-frequency, localized modes. These modes are studied using various models for the electron and ion dynamics (including an integral formalism that retains finite ion gyroradius effects) and considering the effects of density gradients and collisions. A detailed numerical study of the parametric dependence of the mode frequency and structure and a mechanism for anomalous current penetration are presented.

26482 **Absorption of nearly perpendicularly propagating waves in the second harmonic layer.** Imre, K.; Weitzner, H. (Courant Institute of Mathematical Sciences, New York University, New York, New York 10012). *Physics of Fluids;* **28**: No. 6, 1757-1765(Jun 1985). Contract AC02-76ER03077.

Propagation of waves nearly perpendicular to the equilibrium magnetic field and incident to the second electron-cyclotron harmonic layer is investigated in an inhomogeneous weakly relativistic plasma. The resonance region is treated by a boundary layer analysis, and the solutions are matched to the geometrical optics solutions outside the layer. This approach allows one to investigate the transmission, mode coupling, reflection, absorption, and the effects of relativistic broadening. This work extends a previous investigation with the purely perpendicular propagation. It is shown that the mode conversion and reflection rapidly cease to be of importance outside a narrow propagation cone as the doppler broadening becomes predominant. The geometrical optics approach, which breaks down in the purely perpendicular propagation, then becomes valid. It is also shown that the transmission coefficient and the reflection from the high-field side incidence are not altered within this cone.

26483 **Investigation of finite beta modified drift wave in a tokamak plasma.** Fredrickson, E.D.; Bellan, P.M. (California Institute of Technology, Pasadena, California 91125). *Physics of Fluids;* **28**: No. 6, 1866-1876(Jun 1985). Contract FG03-84ER53173.

The saturated state of a low-frequency, coherent, m = 2, global mode has been studied in the Encore tokamak using probe techniques. The mode is found to have large fluctuations in density, electron temperature, space potential, and magnetic field. The experimental measurements were compared with the predictions of a computer code, based on a linear, two-fluid theory of the coupling of drift and shear-Alfven modes. This comparison led to the identification of the mode as a finite beta modified drift wave.

26484 **Stimulated mode conversion at lower-hybrid frequencies.** Andrews, P.L. (GA Technologies Inc., San Diego, California 92138). *Physical Review Letters;* **54**: No. 18, 2022-2025(6 May 1985). Contract AT03-84ER53158.

The prevalence of plasma density fluctuations in tokamaks restricts the applicability of mode-conversion theories based on quiescent plasmas. The fluctuations stimulate mode conversion between otherwise distinct fast and slow cold plasma waves near the lower hybrid frequency. A pair of coupled differential equations representing the two waves is derived and solved under the assumption of random turbulence. This conversion may explain the observed N/sub p/ara spectrum and density cutoff in tokamak lower hybrid current drive experiments.

26485 **Reaching ignition in the tokamak.** Furth, H.P. (Princeton Plasma Physics Laboratory). *Physics Today;* **38**: No. 3, 53-67(Mar 1985). Contract AC02-76CH03073.

Research can continue the 20-year trend toward greater plasma confinement times, densities and temperatures, leading to the full set of ignition parameters by the mid-1990s.

7002 Fusion Power Plant Technology

26486 (CONF-850310—72) Counter current extraction system for tritium recovery from ^{17}Li-^{83}Pb. Sze, D.K. (Argonne National Lab., IL (USA)). Feb 1985. Contract W-31-109-ENG-38. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010519.

From 6. topical meeting on the technology of fusion energy; San Francisco, CA, USA (3 Mar 1985).

A counter current extraction system is proposed here to recover tritium from ^{17}Li-^{83}Pb. The multiple stage extraction system is used to reduce the resistance to the molecular diffusion in the liquid phase, while a counter current helium purge gas is used to reduce the resistance in the gas phase. To reduce the purge gas requirement and alleviate the tritium containment problem, hydrogen is added to the purge gas. An isotope separation system is designed to separate the hydrogen from the tritium.

26487 (CONF-850310—73) Solid breeder/structure mechanical interaction and thermal stability. Liu, Y.Y.; Billone, M.C.; Taghavi, K. (Argonne National Lab., IL (USA); California Univ., Los Angeles (USA)). Apr 1985. Contract W-31-109-ENG-38. 6p. NTIS, PC A02. File Number DE85010520.

From 6. topical meeting on the technology of fusion energy; San Francisco, CA, USA (3 Mar 1985).

Solid breeder/structure mechanical interaction (BSMI) during fusion reactor blanket operation is a potential failure mode which could limit the lifetime of the blanket. The severity of BSMI will generally depend on the materials, specific blanket designs, and blanket operating conditions. Thermomechanical analyses performed for a helium-cooled blanket employing Li_2O/HT-9 plates indicate that BSMI could be a serious concern for this blanket.

26488 (CONF-850310—74) Molten salt cooling/^{17}Li-^{83}Pb breeding blanket concept. Sze, D.K.; Cheng, E.T. (Argonne National Lab., IL (USA); GA Technologies, Inc., San Diego, CA (USA)). Feb 1985. Contract W-31-109-ENG-38. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010522.

From 6. topical meeting on the technology of fusion energy; San Francisco, CA, USA (3 Mar 1985).

A description of a fusion breeding blanket concept using draw salt coolant and static ^{17}Li-^{83}Pb is presented. ^{17}Li-^{83}Pb has high breeding capability and low tritium solubility. Draw salt operates at low pressure and is inert to water. Corrosion, MHD, and tritium containment problems associated with the MARS design are alleviated because of the use of a static LiPb blanket. Blanket tritium recovery is by permeation toward the plasma. A direct contact steam generator is proposed to eliminate some generic problems associated with a tube shell steam generator.

26489 (CONF-850310—75) US blanket technology programs. Nygren, R.E. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010505.

From 6. topical meeting on the technology of fusion energy; San Francisco, CA, USA (3 Mar 1985).

Experimental research in US programs related to blanket technology is described through brief summaries of the objectives, facilities, recent experimental results and principal investigators for the Blanket Technology Program, TRIO-1 Experiment, TSTA, Fusion Hybrid Program and selected activities in the Fusion Materials and Fusion Safety Programs in neutronics research.

26490 (CONF-850310—77) Surface effects on sputtered atoms and their angular and energy dependence. Hassanein, A.M. (Argonne National Lab., IL (USA)). Apr 1985. Contract W-31-109-ENG-38. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010506.

From 6. topical meeting on the technology of fusion energy; San Francisco, CA, USA (3 Mar 1985).

A comprehensive three-dimensional Monte Carlo computer code, Ion Transport in Materials and Compounds (ITMC), has been developed to study in detail the surfaces related phenomena that affect the amount of sputtered atoms and back-scattered ions and their angular and energy dependence. A number of important factors that can significantly affect the sputtering behavior of a surface can be studied in detail, such as having different surface properties and composition than the bulk and synergistic effects due to surface segregation of alloys. These factors can be important in determining and lifetime of fusion reactor first walls and limiters. The ITMC Code is based on Monte Carlo methods to track down the path and the damage produced by charged particles as they slow down in solid metal surfaces or compounds. The major advantages of the ITMC code are its flexibility and ability to use and compare all existing models for energy losses, all known interatomic potentials, and to use different materials and compounds with different surface and bulk composition to allow for dynamic surface composition to allow for dynamic surface composition changes. There is good agreement between the code and available experimental results without using adjusting parameters for the energy losses mechanisms. The ITMC Code is highly optimized, very fast to run and easy to use.

26491 (CONF-850310—78) Neutronics activities for next generation devices. Gohar, Y. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 11p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010488.

From 6. topical meeting on the technology of fusion energy; San Francisco, CA, USA (3 Mar 1985).

Neutronic activities for the next generation devices are the subject of this paper. The main activities include TFCX and FPD blanket/shield studies, neutronic aspects of ETR/INTOR critical issues, and neutronics computational modules for the tokamak system code and tandem mirror reactor system code. Trade-off analyses, optimization studies, design problem investigations and computational models development for reactor parametric studies carried out for these activities are summarized.

26492 (CONF-850310—79) Nuclear responses in INTOR plasma stabilization elements. Gohar, Y.; Mattas, R.F.; Yang, S.; Wiffen, F.W. (Argonne National Lab., IL (USA); Oak Ridge National Lab., TN (USA)). 1985. Contract W-31-109-ENG-38. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010489.

From 6. topical meeting on the technology of fusion energy; San Francisco, CA, USA (3 Mar 1985).

Nuclear responses in the plasma stabilization elements were studied in a parametric fashion as a part of the transient electromagnetics critical issue C of ETR/INTOR activity. The main response are neutron fluence and radiation dose in the insulator material, induced resistively and atomic displacement in the conductor material, nuclear heating and life analysis for the elements. Copper and aluminum conductors with either $MgAl_2O_4$ or MgO insulating material were investigated. Radiation damage and life analysis for these elements were also discussed.

26493 (CONF-850310—80) Tritium system design for the mirror reactors FPD-I, FPD-II, and FPD-III. Finn, P.A. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010490.

From 6. topical meeting on the technology of fusion energy; San Francisco, CA, USA (3 Mar 1985).

The tritium system design for the Fusion Power Demonstration Reactor (FPD-I, II, and III) is described. The device operates at 25% availability. For FPD-II, an engineering mode using tritium neutral beams is part of the design.

26494 (CONF-850310—82) Tritium technology review. Finn, P.A.; Sze, D.K. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010504.

From 6. topical meeting on the technology of fusion energy; San Francisco, CA, USA (3 Mar 1985).

The methods used in recovering, containing and controlling tritium in fusion reactor systems are the subject of the paper. Safety, cost, and breeding needs for tritium control are outlined.

26495 (CONF-850310—83) Alpha particle diagnostic beam line system to generate an intense Li^0 beam with an ORNL SITEX source. Dagenhart, W.K.; Stirling, W.L.; Tsai, C.C.; Whealton, J.H. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010564.

From 6. topical meeting on the technology of fusion energy; San Francisco, CA, USA (3 Mar 1985).

The Oak Ridge National Laboratory (ORNL) SITEX (Surface Ionization with Transverse Extraction) negative ion source utilizes a 100-V/20-A reflex arc discharge in a 1300-gauss magnetic field to generate Cs+ ions and H+ or D+ ions, depending on the beam required. A shaped molybdenum plate is placed directly behind the arc column. Cesium coverage on this plate is used to minimize the surface work function, which requires two-thirds of a monolayer coverage. Cesium coverage is adjusted both by cesium flow control into the arc discharge chamber and by temperature control of the converter using gaseous-helium cooling channels in the converter plate. Normal converter operational temperatures are 300° to 500°C H^-/D^- beams are generated at the biased converter surface (-150 V with respect to the anode) by Cs^+ sputtering of absorbed hydrogen or deuterium and by the reflection-conversion mechanism of H^+/D^+ ions which strike the converter surface at 150 eV. The negative ions are accelerated through the 150-V plasma sheath at the converter surface and are focused by the converter geometry and magnetic field so as to pass through the exit aperture with minimum angular divergence. The ion optics of the SITEX accelerator has been calculated using the ORNL 3-D optics code and results in a divergence perpendicular to the slot of θ/sub perpendicular rms/ = 0.35° and parallel to the slot of θ/sub parallel rms/ = 0.18°. This beam divergence should be adequate for injection into a radio frequency quadrupole (RFQ) for further acceleration.

26496 (CONF-850411—11) 1-D hybrid code for FRM dynamics. Stark, R.A.; Miley, G.H. (Naval Surface Weapons Center, Silver Spring, MD (USA); Illinois Univ., Urbana (USA). Fusion Studies Lab.). 1985. Contract AC02-76ET52040. 12p. (COO—2218-316). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010687.

From International meeting on advances in nuclear engineering computational methods; Knoxville, TN, USA (9 Apr 1985).

A 1-D radial hybrid code has been written to study the start-up of the FRM via neutral-beam injection. This code, named FROST (Field Reversed One-dimensional STart-up), models the plasma as azimuthal symmetric with no axial dependence. A multi-group method in energy and canonical angular momentum describes the large-orbit ions from the beam. This method is designed to be more efficient than those employing particle tracking, since the characteristic timescale of the simulation is the ion slowing down time, rather than the much shorter cyclotron period. A time-differentiated Grad-Shafranov equation couples the ion current to massless fluid equations describing electrons and low energy ions. Flux coordinates are used in this fluid model, in preference to an Eulerian framework, so that coupling of plasma at the two different radii of a closed flux surface may be treated with ease. Since a fluid treatment for electrons is invalid near a field null, a separate model for the electron current has been included for this region, a unique feature. Results of simulation of injection into a 2XIIB-like plasma are discussed. Electron currents are found to retard, but not prevent reversal of the magnetic field at the plasma center.

26497 (CONF-850507—1) Measurement and evaluation of selected 14-MeV neutron cross sections for fusion. Meadows, J.W.; Smith, D.L.; Cox, S.A. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010295.

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Experimental neutron-activation cross-section data in the vicinity of 14 MeV are evaluated for several reactions of fusion-related interest using a least-squares method. New experimental measurements are performed at 14.7 MeV for all of these considered reactions and for some commonly-used standard reactions as well. Comparison is made between measured and evaluated results.

26498 (CONF-850610—9-Summ.) Impurity and particle control systems for tokamak reactor experiments. Mattas, R.F. (Argonne National Lab., IL (USA)). Jan 1985. Contract W-31-109-ENG-38. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85006124.

From Annual meeting of the American Nuclear Society; Boston, MA, USA (9 Jun 1985).

The impurity control systems that have received the greatest emphasis are divertors and pumped limiters. These are numerous engineering requirements that make operation of these systems difficult. The impurity control system must withstand a major part of the energy dissipated during a plasma disruption. The goals of the engineering analyses are first to demonstrate that these systems can operate during normal operation by showing that the heat and particle loads can be accommodated, and second, to demonstrate that these systems have an acceptable lifetime by showing that surface erosion is low, that radiation effects are modest, and that the materials are not subject to long term cracking and failure. The engineering areas that have been considered are materials properties, mechanical configuration, thermal-hydraulic, stress analysis, fabrication, disruption response, sputtering erosion and redeposition, tritium permeation, and lifetime estimates.

26499 (CONF-850610—11-Summ.) STARFIRE-II studies. Summary. Baker, C.C.; Brooks, J.N.; Ehst, D.A.; Smith, D.L.; Sze, D.K. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85006216.

From Annual meeting of the American Nuclear Society; Boston, MA, USA (9 Jun 1985).

The US Department of Energy's Office of Fusion Energy has initiated several studies during FY-1985 called Tokamak Power System Studies (TPSS). The TPSS is being carried out by several laboratories, universities and industry with the general objective of developing innovative physics and technology concepts to improve the commercial attractiveness of tokamak power reactors. The effort of Argonne National Laboratory, entitled STARFIRE-II, is an effort to update and improve STARFIRE, which was the last comprehensive conceptual design study in the US of a commercial tokamak power plant. The STARFIRE-II effort has developed a number of goals in order to improve fusion commercial power plants based in part on several recent studies. The primary goals for STARFIRE-II are listed.

26500 (DOE/DP/40152—1) Inertial fusion research. Annual technical report, 1982. Solomon, D.E.; Loughry, B.W.; Terry, N.C. (eds.). (KMS Fusion, Inc., Ann Arbor, MI (USA)). 1982. Contract AC08-82DP40152. 86p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85011515.

Report KMSF-U1317.

This report is presented in three chapters: (1) experimental work, (2) target technology, and (3) theory and computation. The experimental work was on the following: (1) transport in spherical geometry, (2) cryogenic implosions, (3) x-ray spectroscopy, and (4) lasers and diagnostics. Target studies were conducted on glass shells, radiography, cryogenics, and fabrication. (MOW)

26501 (DOE/DP/40192—1) Shifts and widths of hydrogenic ion lines. Final report, 1 October 1983-30 September 1984. Griem, H.R. (Maryland Univ., College Park (USA). Lab. for Plasma and Fusion Energy Studies). Mar 1985. Contract AS08-84DP40192. 29p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85011375.

The resonance lines of C VI, N VII, and O VIII were studied in laser-produced plasmas. Use was made of the multi-beam Omega laser system (at the Laboratory of Laser Energetics at the University of Rochester) to produce dense plasmas with electron densities (N/sub e/) in the range 10^{21} to $10^{23}cm^{-3}$ from spherical microballoons. The lasers were operated at two wavelengths - 1.06 μm and 3513A. The observed resonance lines of the hydrogen-like ions do not show any shift larger than the experimental accuracy. A new analysis of the experimental data of Adcock and Griem is also presented. According to the new analysis no line shift was obtained in that experiment either, and the reported shifts were due to an error in the wavelength calibration. The results of the present experiment and those of Adcock and Griem indicate that the reso-

nance lines of C VI are unshifted to within an experimental accuracy of +-0.015A. A discussion of the implications of the present results and some other experimental shift studies for several plasma shift models is also given, indicating a general disagreement between most models and experiments.

26502 **(DOE/ER/10107—26) Yield stress determination from miniaturized disk bend test data.** Sohn, D.S.; Kohse, G.; Harling, O.K. (Massachusetts Inst. of Tech., Cambridge (USA)). Apr 1985. Contract AC02-78ER10107. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85009495.

Methodology for testing 3.0 mm diameter by 0.25 mm thick disks by bending in a punch and die has been described previously. This paper describes the analysis of load/deflection data from such miniaturized disk bend tests (MDBT) using a finite element simulation. Good simulation has been achieved up to a point just beyond the predominantly elastic response, linear initial region. The load at which deviation from linearity begins has been found to correlate with yield stress, and yield stress has been successfully extracted from disk bend tests of a number of known materials. Although finite element codes capable of dealing with large strains and large rotations have been used, simulation of the entire load/deflection curve up to fracture of the specimen has not yet been achieved.

26503 (DOE/ER/10275—1A, pp 1, Paper 11) **Modelling of tritium behavior in solid breeder blankets of conceptual fusion reactors.** Kessel, C.E. Jr. (Univ. of California, Santa Barbara). 1982. NTIS, PC A03/MF A01. File Number DE83004080. (CONF-820359—Absts.).

From Western regional American Nuclear Society student conference; Corvallis, OR, USA (28 Mar 1982).

26504 **(EGG-M—20884) Modeling and experiments on tritium permeation in fusion reactor blankets.** Holland, D.F.; Longhurst, G.R. (EG and G Idaho, Inc., Idaho Falls (USA)). 1985. Contract AC07-76ID01570. 8p. (CONF-850405—6). NTIS, PC A02/MF A01; GPO Dep. File Number DE85008439.

From 2. national topical meeting on tritium technology in fission, fusion and isotopic applications; Dayton, OH, USA (30 Apr 1985).

Issues are discussed that are critical in determining tritium loss from helium-cooled fusion breeding blankets. These issues are: (1) applicability of present models to permeation at low tritium pressures; (2) effectiveness of oxide layers in reducing permeation; (3) effectiveness of hydrogen addition as a means to lower tritium permeation, and (4) effectiveness of conversion to tritiated water and subsequent trapping as a means to reduce permeation. The paper discusses theoretical models applicable to these issues, and presents results of experiments in two areas: permeation of mixtures of hydrogen isotopes and conversion to tritiated water.

26505 **(GA-A—17881) Nuclear data needs for fusion energy development.** Cheng, E.T. (GA Technologies, Inc., San Diego, CA (USA)). Jan 1985. Contract AT03-84ER53158. 11p. (CONF-850310—76). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010445.

From 6. topical meeting on the technology of fusion energy; San Francisco, CA, USA (3 Mar 1985).

As part of the US DOE Office of Fusion Energy Nuclear Data Needs program, we have continued assessment of the nuclear data needs for the development of fusion energy. We have identified and reviewed the high priority elements whose neutron emission data are needed for a near-term fusion ignition facility and fusion power reactor designs for demonstrating the scientific and engineering feasibilities of fusion energy. We found that most of the elements identified here are lacking experimental data from 6 to 15 MeV except hydrogen, lithium, beryllium, and copper. A list of high priority dosimetry cross sections was developed that includes some 29 reactions, including 6 reactions recommended by the plasma diagnostic group of PPPL. Of these 29 reactions, 18 cross sections were chosen to be included in the ENDF/B-VI dosimetry files. The activation cross sections needed for elements to be used in the near-term ignition device and future power reactors were compiled. These cross sections were prioritized according to their activation levels and half-lives of their activation products. All these cross sections are going to be included in the END/B-VI activation files.

26506 **(LA-UR—85-1315) Hybrid two-dimensional Monte-Carlo electron transport in self-consistent electromagnetic fields.** Mason, R.J.; Cranfill, C.W. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 13p. (CONF-8504110—11). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010757.

From Joint Los Alamos/CEA meeting on Monte Carlo methods; Cadarache, France (22 Apr 1985).

The physics and numerics of the hybrid electron transport code ANTHEM are described. The need for the hybrid modeling of laser generated electron transport is outlined, and a general overview of the hybrid implementation in ANTHEM is provided. ANTHEM treats the background ions and electrons in a laser target as coupled fluid components moving relative to a fixed Eulerian mesh. The laser converts cold electrons to an additional hot electron component which evolves on the mesh as either a third coupled fluid or as a set of Monte Carlo PIC particles. The fluids and particles move in two-dimensions through electric and magnetic fields calculated via the Implicit Moment method. The hot electrons are coupled to the background thermal electrons by Coulomb drag, and both the hot and cold electrons undergo Rutherford scattering against the ion background. Subtleties of the implicit E- and B-field solutions, the coupled hydrodynamics, and large time step Monte Carlo particle scattering are discussed. Sample applications are presented.

26507 **(LA-UR—85-1489) Mechanical considerations in cw linacs.** King, J.D. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 4p. (CONF-850504—7). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010728.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

An 80-MHz radio-frequency quadrupole (RFQ) linac has been designed, fabricated and operated at 100% duty factor (cw) for the Fusion Materials Irradiation Test (FMIT) project at Los Alamos. This paper describes the design features, fabrication techniques, and operational problems of the device. The RFQ is an assembly of heavy steel, copper-plated weldments. It measures about 15 ft (4.5 m) long by 5 ft (1.5 m) in diameter and weighs over 12 t. Major components are two pair of diametrically orthogonal vanes mounted in a core cylinder. The core is assembled into a manifold cylinder that couples rf power into the vane quadrants. The design features discussed include assembly of hollow wall, flood-cooled components; high-conductivity rf seals; removable and adjustable vanes; and tuning devices. Fabrication challenges such as close-tolerance weldments, vane-tip-contour machining and large-component plating requirements are covered.

26508 **(NRL-Memo—5560) Plasma Erosion Opening Switch.** Commisso, R.J.; Cooperstein, G.; Meger, R.A.; Neri, J.M.; Ottinger, P.F.; Weber, B.V. (JAYCOR, Alexandria, VA (USA)). 14 May 1985. Contract AI08-79DP40092. 45p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85011384.

The Plasma Erosion Opening Switch (PEOS) can conduct high current (~ MA), open quickly (<10ns), and withstand high voltage (~ MV). This switching technique has been used in inductive energy storage experiments and can be used with existing generators for pulse compression, voltage multiplication and power multiplication. The PEOS is used routinely for other types of power conditioning including prepulse suppression, pulse sharpening and multimodule jitter reduction. This paper is a review of the PEOS work to date. It reviews basic physics principles of the PEOS and outlines the operational limits of a system that employs a PEOS. Examples of present applications of the PEOS are also discussed.

26509 (ORNL/TM—9493) Introduction to programming multiple-processor computers. Hicks, H.R.; Lynch, V.E. (Oak Ridge National Lab., TN (USA)). Apr 1985. Contract AC05-84OR21400. 24p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010274.

FORTRAN applications programs can be executed on multiprocessor computers in either a unitasking (traditional) or multitasking form. The latter allows a single job to use more than one processor simultaneously, with a consequent reduction in wall-clock time and, perhaps, the cost of the calculation. An introduction to programming in this environment is presented. The concepts of synchronization and data sharing using EVENTS and LOCKS are illustrated with examples. The strategy of strong synchronization and the use of synchronization templates are proposed. We emphasize that incorrect multitasking programs can produce irreproducible results, which makes debugging more difficult.

26510 (UCRL—91589) Development of the cascade inertial-confinement-fusion reactor. Pitts, J.H. (Lawrence Livermore National Lab., CA (USA)). 15 Apr 1985. Contract W-7405-ENG-48. 7p. (CONF-850310—86). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010933.

From 6. topical meeting on the technology of fusion energy; San Francisco, CA, USA (3 Mar 1985).

Cascade, originally conceived as a football-shaped, steel-walled reactor containing a Li_2O granule blanket, is now envisaged as a double-cone-shaped reactor containing a two-layered (three-zone) flowing blanket of BeO and $LiAlO_2$ granules. Average blanket exit temperature is 1670°K and gross plant efficiency (net thermal conversion efficiency) using a Brayton cycle is 55%. The reactor has a low-activation SiC-tiled wall. It rotates at 50 rpm, and the granules are transported to the top of the heat exchanger using their peripheral speed; no conveyors or lifts are required. The granules return to the reactor by gravity. After considerable analysis and experimentation, we continue to regard Cascade as a promising reactor concept with the advantages of safety, efficiency, and low activation.

26511 (UCRL—91643) Pulse Star inertial confinement fusion reactor. Blink, J.A.; Hogan, W.J. (Lawrence Livermore National Lab., CA (USA)). 15 Apr 1985. Contract W-7405-ENG-48. 6p. (CONF-850310—89). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010940.

From 6. topical meeting on the technology of fusion energy; San Francisco, CA, USA (3 Mar 1985).

Pulse Star is a pool-type ICF reactor that emphasizes low cost and high safety levels. The reactor consists of a vacuum chamber (belljar) submerged in a compact liquid metal ($Li_{17}Pb_{83}$ or lithium) pool which also contains the heat exchangers and liquid metal pumps. The shielding efficiency of the liquid metal pool is high enough to allow hands-on maintenance of (removed) pumps and heat exchangers. Liquid metal is allowed to spray through the 5.5 m radius belljar at a controlled rate, but is prohibited from the target region by a 4 m radius mesh first wall. The wetted first wall absorbs the fusion x-rays and debris while the spray region absorbs the fusion neutrons. The mesh allows vaporized liquid metal to blow through to the spray region where it can quickly cool and condense. Preliminary calculations show that a 2 m thick first wall could handle the mechanical (support, buckling, and x-ray-induced hoop) loads. Wetting and gas flow issues are in an initial investigation stage.

26512 (UCRL—91647) Advances in ICF power reactor design. Hogan, W.J.; Kulcinski, G.L. (Lawrence Livermore National Lab., CA (USA); Wisconsin Univ., Madison (USA). Dept. of Nuclear Engineering). 17 Apr 1985. Contract W-7405-ENG-48. 11p. (CONF-850310—84). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010930.

From 6. topical meeting on the technology of fusion energy; San Francisco, CA, USA (3 Mar 1985).

Fifteen ICF power reactor design studies published since 1980 are reviewed to illuminate the design trends they represent. There is a clear, continuing trend toward making ICF reactors inherently safer and environmentally benign. Since this trend accentuates inherent advantages of ICF reactors, we expect it to be further emphasized in the future. An emphasis on economic competitiveness appears to be a somewhat newer trend. Lower cost of electricity, smaller initial size (and capital cost), and more affordable development paths are three of the issues being addressed with new studies.

26513 (UCRL—91737) Technical and historical overview of the study at Livermore of porous antireflection coatings. Milam, D. (Lawrence Livermore National Lab., CA (USA)). 4 Apr 1985. Contract W-7405-ENG-48. 24p. (CONF-850345—24). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010925.

From Southwest conference on optics; Albuquerque, NM, USA (4 Mar 1985).

The testing program leading to selection of antireflection coatings for the NOVA laser is reviewed. Limiting problems that prevented use of some coating technologies are described, and estimates are made of the current value of pursuing solutions to those problems.

26514 (UCRL—92024) Design of a helium-cooled molten salt fusion breeder. Moir, R.W.; Lee, J.D.; Fulton, F.J.; Huegel, F.; Neef, W.S. Jr.; Sherwood, A.E.; Berwald, D.H.; Whitley, R.H.; Wong, C.P.C.; DeVan, J.H. (Lawrence Livermore National Lab., CA (USA); TRW Energy Development Group, Redondo Beach, CA (USA); GA Technologies, Inc., San Diego, CA (USA); Oak Ridge National Lab., TN (USA); Bechtel National, Inc., Oak Ridge, TN (USA)). Feb 1985. Contract W-7405-ENG-48. 10p. (CONF-850310—71). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010474.

From 6. topical meeting on the technology of fusion energy; San Francisco, CA, USA (3 Mar 1985).

A new conceptual blanket design for a fusion reactor produces fissile material for fission power plants. Fission is suppressed by using beryllium, rather than uranium, to multiply neutrons and also by minimizing the fissile inventory. The molten-salt breeding media ($LiF + BeF_2 + TghF_4$) is circulated through the blanket and on to the online processing system where ^{233}U and tritium are continuously removed. Helium cools the blanket including the steel pipes containing the molten salt. Austenitic steel was chosen because of its ease of fabrication, adequate radiation-damage lifetime, and low corrosion rate by molten salt. We estimate the breeder, having 3000 MW of fusion power, produces 6400 kg of ^{233}U per year, which is enough to provide make up for 20 GWe of LWR per year (or 14 LWR plants of 4440 MWt) or twice that many HTGRs or CANDUs. Safety is enhanced because the afterheat is low and the blanket materials do not react with air or water. The fusion breeder based on a pre-MARS tandem mirror is estimated to cost $4.9B or 2.35 times an LWR of the same power. The estimated present value cost of the $^{2}a\#^{3}U$ produced is $40/g if utility financed or $16/g if government financed.

26515 (UCRL—92025) Qualitative comparisons of fusion reactor materials for waste handling and disposal. Maninger, R.C. (Lawrence Livermore National Lab., CA (USA)). 8 Apr 1985. Contract W-7405-ENG-48. 11p. (CONF-850310—70). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010473.

From 6. topical meeting on the technology of fusion energy; San Francisco, CA, USA (3 Mar 1985).

The activation of five structural materials and seven coolant/breeder/multiplier materials in a common reference neutron environment was calculated with the FORIG activation code. The reference environment was the neutron flux and spectrum at the first wall of the mirror advanced reactor study (MARS) reactor. Qualitative comparison of these activated materials were made with respect to worker protection requirements for gamma radiation in handling the materials and with respect to their classifications for near-surface disposal of radioactive waste.

26516 (UCRL—92212) Magnetic fusion 1985: what next. Fowler, T.K. (Lawrence Livermore National Lab., CA (USA)). Mar 1985. Contract W-7405-ENG-48. 12p. (CONF-850310—63). NTIS, PC A02/MF A01; GPO Dep. File Number DE85009953.

From 6. topical meeting on the technology of fusion energy; San Francisco, CA, USA (3 Mar 1985).

Recent budget reductions for magnetic fusion have led to a re-examination of program schedules and objectives. Faced with delays and postponement of major facilities as previously planned, some have called for a near-term focus on science, others have stressed technology. This talk will suggest a different focus as the keynote for this conference, namely, the applications of fusion. There is no doubt that plasma science is by now mature and fusion technology is at the forefront. This has and will continue to benefit many fields of endeavor, both in actual new discoveries and techniques and in attracting and training scientists and engineers who move on to make significant contributions in science, defense and industry. Nonetheless, however superb the science or how challenging the technology, these are means, not ends. To maintain its support, the magnetic fusion program must also offer the promise of power reactors that could be competitive in the future. At this conference, several new reactor designs will be described that claim to be smaller and economically competitive with fission reactors while retaining the environmental and safety characteristics that are the hallmark of fusion. The American Nuclear Society is an appropriate forum in which to examine these new designs critically, and to stimulate better ideas and improvements. As a preview, this talk will include brief discussions of new tokamak, tandem mirror and reversed field pinch reactor designs to be presented in later sessions. Finally, as a preview of the session on fusion breeders, the talk will explore once again the economic implications of a new nuclear age, beginning with improved fission reactors fueled by fusion breeders, then ultimately evolving to reactors based solely on fusion.

26517 (UCRL—92248) Progress in inertial fusion at LLNL. Storm, E. (Lawrence Livermore National Lab., CA (USA)). 15 Apr 1985. Contract W-7405-ENG-48. 10p. (CONF-850310—85). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010931.

From 6. topical meeting on the technology of fusion energy; San Francisco, CA, USA (3 Mar 1985).

Experiments at LLNL using the 10 TW Novette laser have led to significantly increased understanding of laser/plasma coupling. Tests using 1.06 μm, 0.53 μm and 0.26 μm light have shown increased light absorption, increased efficiency of conversion to x-rays, and decreased production of suprathermal electrons as the wavelength of the incident light decreases. The data indicate that stimulated Raman scattering is the source of the excessive hot electrons and that the effect can be controlled by the proper selection of laser frequency and target material. The control of these effects has led to achievement of higher inertial fusion target compressions and to production of the first laboratory x-ray laser.

26518 (UCRL—92262) Effects of laser radiation on surfaces and coatings. Lowdermilk, W.H. (Lawrence Livermore National Lab., CA (USA)). 1 Mar 1985. Contract W-7405-ENG-48. 40p. (CONF-850345—19). NTIS, PC A03/MF A01; GPO Dep. File Number DE85010475.

From Southwest conference on optics; Albuquerque, NM, USA (4 Mar 1985).

A summary is given of the principal aspects of laser-induced damage to polished optical surfaces and dielectric, thin-film, high-reflectivity and antireflective coatings. Methods for producing porous antireflective surfaces and coatings and their damage properties are also reviewed. Finally, new areas of basic research to solve current and future problems are addressed.

26519 Inertial effects in laser-driven ablation. Harrach, R.J.; Szoeke, A.; Howard, W.M. (Lawrence Livermore National Lab., CA). pp 335-337 of Shock waves in condensed matter - 1983. Asay, J.R.; Graham, R.A.; Straub, G.K. (eds.). New York, NY; Elsevier Science Publishers B.V. (1984).

The gasdynamic partial differential equations (PDE's) governing the motion of an ablatively accelerated target (rocket) contain an inertial force term that arises mathematically from acceleration of the reference frame in which the PDE's are written, and more physically from the requirement that part of the ablated mass (the deflagration wave zone) needs to be accelerated along with the unablated mass (payload). We give a simple, intuitive description of this effect, and estimate its magnitude and parametric dependences by means of approximate analytical formulas inferred from our computer hydrocode calculations. Often this inertial term is negligible, but for problems in the areas of laser fusion and laser equation of state studies we find that it can reduce the attainable hydrodynamic efficiency of acceleration and implosion by up to 25% for typical conditions.

99 GENERAL AND MISCELLANEOUS

26520 (LA—10310) Institutional Supporting Research and Development 1984. Motz, H. (comp.). (Los Alamos National Lab., NM (USA)). Feb 1985. Contract W-7405-ENG-36. 79p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85010542.

This report presents twenty-six articles on projects currently supported by the Institutional Supporting Research and Development Program at Los Alamos National Laboratory. Articles are grouped into several categories: materials sciences, techniques/instrumentation/devices, life sciences, mathematics and computer sciences, and general physics and chemistry. Much of the work reported here relies on multidisciplinary approaches; it encompasses not only basic research but also important, technically challenging applied research relevant to the Laboratory's mission.

9901 Management

26521 (DOE/MA—0087) Cost and schedule control systems criteria for contract performance measurement. Implementation guide. (USDOE Assistant Secretary for Management and Administration, Washington, DC. Office of the Controller). May 1980. 107p. NTIS, PC A06/MF A01; 1; ; GPO Dep. File Number DE85010699.

This document provides uniform guidance for implementation of the DOE Order 2250.1, Cost and Schedule Control Systems Criteria (CSCSC) for Contract Performance Measurement. It will assist both DOE and contractor representatives in fulfilling their responsibilities for meeting CSCSC requirements. Implementation of the Criteria consistent with the guidance contained herein will avoid imposition of separate duplicate management control systems on contractors. Compliance with the contractual requirements for work definition, cost and schedule control, and performance reporting will provide increased assurance that a contractor's progress is sufficiently visible to reliably indicate status and to provide the basis for timely and meaningful management decisions.

26522 (Zfl-Mitt—82) Reports of the Central Institute for Isotopes and Radiation Research. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Nov 1983. 177p. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE85780872.

Individual reports are indexed.

9902 Mathematics And Computers

REFER ALSO TO CITATION(S) 25303, 25588

26523 (AD-A—149812/0/XAB) Parallel processing of encoded bit strings. Technical report. Wu, A.Y. (Maryland Univ., College Park (USA). Center for Automation Research). Nov 1984. 26p. NTIS, PC A03/MF A01.

Many operations on strings of length n can be speeded up by a factor of p using p processors. String operations can also be speeded up, even when a single processor is used, by compactly encoding the strings, e.g. using run length code. This paper shows how to combine these two approaches by using p processors to process compactly encoded strings. The author studies various representations of bit strings and parallel algorithms to process these representations using a multiprocessor system. Section 2 describes the parallel processing model used. Sections 3 and 4 discuss various compact representations of strings, and their conversions to each other. Section 5 presents algorithms to process run length coded

strings. Section 6 briefly discusses the extension of this work to representations of two-dimensional objects.

26524 (ANL/MCS-TM—34) Programming the next generation of supercomputers: proceedings for the Argonne workshop. Smith, B.T.; Dongarra, J.J.; Messina, P.C. (eds.). (Argonne National Lab., IL (USA)). Oct 1984. Contract W-31-109-ENG-38. 304p. (CONF-8402139—). NTIS, PC A14/MF A01; 1; GPO Dep. File Number DE85008348.

From Argonne workshop on programming the next generation of supercomputers; Albuquerque, NM, USA (27 Feb 1984).

The Argonne National Laboratory workshop titled "Programming the Next Generation of Supercomputers" was held at the Amfac Hotel in Albuquerque, New Mexico. The purpose of the workshop was to gather together researchers from the DOE laboratories who were using multiprocessors and to have these investigators relate their experiences with the programming languages supplied with these processors. The goal was to identify those areas where additional language primitives would aid in the development of portable software. Upon the identification of such needs, extensions to the Fortran language would then be proposed to such groups as the DOE Language Working Group and the X3J3 Fortran committee for further study. The topics presented at the workshop included reviews of existing languages that address concurrency and parallel computation, presentations on portable programming methods for parallel processing, users' views of what is needed to program multiprocessors, and the supplier's views of what is needed to drive their processors. This report collects the presentations given at this workshop and records the organized discussion held after each presentation and each session. In most cases, the materials reproduced here are the slides given by each author at the workshop. In some cases, papers were prepared by the authors and included in this report. A summary of the conclusions reached by the workshop is also included.

26525 (ANL/MCS-TM—42) Symposium on computational mathematics - state-of-the-art: informal proceedings. (Argonne National Lab., IL (USA)). Dec 1984. Contract W-31-109-ENG-38. 248p. (CONF-840938—Summs.). NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE85008122.

From State-of-the-art in computational mathematics; Argonne, IL, USA (20 Sep 1984).

Topics covered include: some problems in the scaling of matrices; matrix calculations in optimization algorithms; numerical solution of differential-algebraic equations; the requirements of interactive data analysis systems; linear algebra problems in multivariate approximation theory; computational linear algebra in continuation and two point boundary value problems; second thoughts on the mathematical software effort, a perspective; enhanced resolution in shock wave calculations; Givens' Eigenvector recurrence revisited; and the state-of-the-art in error analysis. Individual presentations are included as copies of transparencies used by the speakers. Abstracts were prepared for the individual presentations and are included in the data base. (GHT)

26526 (BDX—613-3074) Computerized laboratory analytical and diagnostic services (CLADS). Final report. Genser, D.S.; Holland, L.L. (SEE CODE- 9519311 Bendix Corp., Kansas City, MO (USA)). Apr 1985. Contract AC04-76DP00613. 54p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85010854.

Small computer systems are applied to individual laboratory instruments for equipment control, data acquisition, and local buffering of data. A general-purpose laboratory computer system is connected to several of these computer-aided instruments over serial links. The general purpose system provides capabilities for data reduction, plotting, report preparation, and data archival on microfiche. Benefits have included increased instrument capacity, improved analytical capabilities, and cost avoidances of $1,266,000 during the first four years.

26527 (BDX—613-3231) Combined finite element meshing techniques using SUPERTAB. Final report. Schrank, M.G. (SEE CODE- 9519311 Allied Bendix Aerospace, Kansas City, MO (USA)). May 1985. Contract AC04-76DP00613. 14p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85011393.

A technique has been created to combine the mapped mesh and free mesh generation capabilities of the SUPERTAB finite element modeling program within the same model. Element compatibility between regions where the two methods are to be used is attained by forcing the unmapped elements to match the mapped elements at the common boundary. This report presupposes a knowledge of the SUPERTAB software.

26528 (BDX—613-3243) Using MATHLIB on the IBM computer and sundry plotting examples with a taste of IMSL. Emery, J.D. (SEE CODE- 9519311 Allied Bendix Aerospace, Kansas City, MO (USA)). May 1985. Contract AC04-76DP00613. 42p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85011395.

MATHLIB is a FORTRAN subroutine library. It contains routines for solving various problems numerically. This report shows how to use MATHLIB on the IBM computer. Also, examples of TEKTRONIX and HEWLETT-PACKARD plotting are given. An example using the IMSL library is included.

26529 (CONF-841249—) Proceedings of the Digital Equipment Computer Users Society: presentations and reports, USA Fall 1984. Snyder, J.M. (ed.). (Digital Equipment Computer Users Society, Marlboro, MA (USA)). 1985. 612p. Digital Equipment Corp., 249 Northboro Rd., BP02, Marlboro, MA 01752. File Number TI85901280.

From Fall DECUS symposium; Anaheim, CA, USA (10 Dec 1984).

Several articles sponsored by DOE were prepared for the data base. Topics covered by the conference include data acquisition analysis for research and control, data management systems, datatrieve, EDU, graphic applications, hardware micro, IAS, languages and tools, large systems, networks, office automations, site management and training, RT-11, UNIX, and VAX systems. (GHT)

26530 (CONF-8411140—4) Performance and library issues for mathematical software on high performance computers. Dongarra, J.J.; Sorensen, D.C. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 24p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010263.

From ARO workshop on new computing environments: parallel, vector and systolic; Stanford, CA, USA (7 Nov 1984).

This paper discusses some of the fundamental issues facing designers of mathematical software libraries for medium scale parallel processors such as the CRAY X-MP-4 and the Denelcor HEP. We discuss the problems that arise with performance and demonstrate that it may be appropriate to exploit parallelism at all levels of the program, not just at the highest level. We give performance measurements indicating the efficiency of a linear algebra library written in terms of a few high level modules. These modules chosen at the matrix vector level extend the concept of the BLAS and provide enough computational granularity to allow efficient implementations on a wide variety of architectures. Only three modules must be recoded for efficiency in order to transport the library to various machines. We report experience on machines as diverse as the CRAY X-MP and the Denelcor HEP. Finally, we report on some special algorithms for the HEP which take advantage of the fine grain parallelism capabilities.

26531 (IFUSP-P—383) Errors in experiments with small number of events. Helene, O.A.M. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Feb 1983. 25p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700612.

The determination of errors of the results of experiments with small number of events is discussed. Tables of confidence intervals for Poisson distribution and for the ratio and the difference between small numbers of events are presented. The procedure is checked using a Monte Carlo simulation. The use of the tables are shown through the analysis and reevaluation of some experimental results already published. The Bayesian statistical approach is adopted.

26532 (LA-UR—85-1175) SABRINA: an interactive solid geometry modeling program for Monte Carlo. West, J.T. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 15p. (CONF-8504110—4). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010796.

From Joint Los Alamos/CEA meeting on Monte Carlo methods; Cadarache, France (22 Apr 1985).

SABRINA is a fully interactive three-dimensional geometry modeling program for MCNP. In SABRINA, a user interactively constructs either body geometry, or surface geometry models, and interactively debugs spatial descriptions for the resulting objects. This enhanced capability significantly reduces the effort in constructing and debugging complicated three-dimensional geometry models for Monte Carlo Analysis.

26533 (LA-UR—85-1194) MECA: a multiprocessor concept specialized to Monte Carlo. Solem, J.C. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 13p. (CONF-8504110—5). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010791.

From Joint Los Alamos/CEA meeting on Monte Carlo methods; Cadarache, France (22 Apr 1985).

Discrete-ordinates and Monte Carlo techniques are compared for solving integrodifferential equations and compare their relative adaptability to vector processors. The author discusses the utility of multiprocessors for Monte Carlo calculations and describes a simple architecture (the monodirectional edge-coupled array or MECA) that seems ideally suited to Monte Carlo and overcomes many of the packaging problems associated with more general multiprocessors. 18 refs., 3 figs., 1 tab.

26534 (LA-UR—85-1312) Expanding expertise by use of an expert system. Kyle, T.G. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 8p. (CONF-8504117—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010759.

From Intelligent systems and machines conference; Rochester, MI, USA (22 Apr 1985).

By constructing an expert system as a research project proceeds it is possible to aid the development of expertise within the research project. This benefit occurs because there is a need for rules in the construction of the system and this motivates the researchers to formalize and relate the rules that researchers are constantly forming. There is also a benefit because each researcher putting his newly formed knowledge into the system makes it available to all other participants in the project. When the project involves complex scientific phenomena the use of interconncected simple mathematical models is needed to properly express the relations. The ability of the models to represent the values of a field of parameters permits researchers to refer to the individual phenomena within the realm of the model without having to reexpress all the complex relationships the model approximates. The model is still useful even when the rules being input into the expert system involve modifications that must be applied to the model output in particular situations.

26535 (LBL—18987) Nonlinear dynamics: a personal perspective. Laslett, L.J. (Lawrence Berkeley Lab., CA (USA)). Dec 1984. Contract AC03-76SF00098. 114p. (CONF-850114—1). NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85010982.

From Joint US/CERN School on Particle Accelerators topical course on non-linear dynamics; Sardinia, Italy (31 Jan 1985).

The discussion includes development of stochasticity from area-preserving transformations, limiting (resonant) frequencies for particle motion in the median plane of a strong-focusing ring, and bifurcation. (GHT)

26536 (PNL-SA—12772) Interactive graphics for a data analysis management system. Whiting, M.A.; Cowley, P.J.; Carr, D.B.; Nicholson, W.L. (Pacific Northwest Labs., Richland, WA (USA)). Dec 1984. Contract AC06-76RL01830. 13p. (CONF-8504121—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010977.

From Computer graphics '85; Dallas, TX, USA (14 Apr 1985).

Interactive graphical functions form the basis of a system that assists the data analyst in managing the data analysis process. Dynamic tree structures depict the progress of the analysis by showing the paths taken and milestones reached. Pop-up menus guide the user through the data management options offered by the system. Overlapping priority windows provide an increasing level of detail of the various components of the data analysis tree. The system as a whole provides a graphical reference guide and an automated bookkeeping aid to analysts attempting to perform organized data analyses.

26537 (SAND—85-0510) Apollo Multiplexer operations manual. Miller, M.M. (Sandia National Labs., Albuquerque, NM (USA)). Apr 1985. Contract AC04-76DP00789. 20p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85011293.

This report describes the operation of the the Apollo Multiplexer, a microprocessor based communications device designed to process data between an Apollo computer and up to four Gandalf PACXIV data switches. Details are given on overall operation, hardware, and troubleshooting. The reader should gain sufficient knowledge from this report to understand the operation of the multiplexer and effectively analyze and correct any problems that might occur.

26538 (SAND—85-0530C) DES: applications and uses. Burnham, B.W. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 2p. (CONF-850428—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010121.

From 8. DOE Computer Security Group conference; Richland, WA, USA (16 Apr 1985).

DES is an abbreviation for Data Encryption Standard. This "Standard" is set forth in an assortment of federal standards, primarily Federal Information Processing Standards Publications (Fips Pub) No. 46, January 15, 1977. This standard describes the Data Encryption Algorithm (DEA). This algorithm is the result of a short-term relationship between IBM and the federal government. The specification of the algorithm (DEA) has fallen into disuse and currently (DES) is the standard description. The DES algorithm is a block-oriented (as opposed to bit-oriented) invertible encryption algorithm. A single key is used to encrypt the data and the same key is required to decrypt the cypher text. The algorithm, in its basic form, accepts data blocks of 64 bits and produces 64 bits of cypher text per "cycle". The algorithm is invertible in the sense that the same algorithm run "backwards" with the same key undoes the encryption. Since the algorithm is invertible, the security of the cryptographic system rests on the protection and security afforded the key.

26539 (SAND—85-0687) Solving Volterra integral equations with ODE codes. Shampine, L.F. (Sandia National Labs., Albuquerque, NM (USA)). Apr 1985. Contract AC04-76DP00789. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85011216.

Some nonlinear Volterra integral equations are equivalent to an initial value problem for a system of ordinary differential equations (ODEs). Because effective ODE codes are widely available, some authors have sought to exploit this connection for the numerical solution of the integral equations. There are two major difficulties: One would like to solve large systems of ODEs. The initial value problem for the ODEs may be stiff. The initial value problems are shown to have a remarkable structure which can be exploited to overcome these two difficulties.

26540 (SAND—85-0825) CMP: Code Maintenance Package reference manual, Version 2.0. Thompson, S.L. (Sandia National Labs., Albuquerque, NM (USA)). Apr 1985. Contract AC04-76DP00789. 48p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85011396.

The Code Maintenance Package (CMP) is a set of programs that provide a method of maintaining computer programs and other data sets. CMP provides an update processor, update correction set generation by file comparison, deck sorting and various file handling utilities. Library files can be written in a system independent

mode and transferred between different computer systems without loss of correction history. The CMP package is written in strict FORTRAN 77 and can be used on any system with sufficient memory and a full standard compiler.

26541 (SAND—85-0952C) Recovery of lost files from VAX/VMS disk structures: a case study. Ebinger, L.W. (Sandia National Labs., Albuquerque, NM (USA)). May 1985. Contract AC04-76DP00789. 14p. (CONF-8505131—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010652.

From Spring DECUS symposium; New Orleans, LA, USA (27 May 1985).

Having a corrupted system disk can be a scarey thing. This paper will describe the somewhat humorous events leading up to the destruction of the file structure on the only good copy of our VMS system disk. This disk unfortunately also contained all of the user files. The method used for file recovery will be detailed. Copies of the programs developed to recover the files will be available. Other recovery programs will also be noted.

26542 (SLAC-TN—85-2) MANHIST user's guide. Besset, D. (Princeton Univ., NJ (USA); Stanford Linear Accelerator Center, CA (USA)). Mar 1985. Contract AC03-76SF00515. 117p. NTIS, PC A06/MF A01; GPO Dep. File Number DE85010684.

MANHIST is a program allowing interactive manipulation of histograms, e.g., retrieving histograms from files, cataloging, displaying and fitting. It can be run on any VMS system and accepts DCL like commands. MANHIST is built upon the CERN histogram packages HBOOK and HPLOT and the Unified Graphic System from SLAC.

26543 (UCID—20347) T/sub E/Xfont tables. Poggio, M.E. (Lawrence Livermore National Lab., CA (USA)). 15 Mar 1985. Contract W-7405-ENG-48. 300p. NTIS, PC A13/MF A01; 1; GPO Dep. File Number DE85011394.

This document is a reference guide to the standard font distribution set available with the T/sub E/X82 system. T/sub E/X is a computerized typesetting system created by Professor Donald E. Knuth at Stanford University. The system provides sophisticated typesetting capabilities including versatile facilities for typesetting mathematical material. T/sub E/X runs on a wide variety of computers and drives a wide variety of output devices. The first chapter of this document provides an introduction that interprets the cryptic font names and gives an explanation regarding font sizing. Each of the remaining chapters presents all of the fonts available at a given magnification step. Within each chapter, each page is a table showing every character that is available in a particular font at the given magnification step.

26544 (UCRL—91623) High gain adaptive control of decentralized systems. Gavel, D.T.; Siljak, D.D. (Lawrence Livermore National Lab., CA (USA); Santa Clara Univ., CA (USA)). 5 Oct 1984. Contract W-7405-ENG-48. 17p. (CONF-850622—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001566.

From American Control conference; Boston, MA, USA (19 Jun 1985).

An adaptive control algorithm is presented for a class of decentralized single-input-single-output systems. We assume that interconnections enter the subsystems at the same points as the control inputs. Tracking errors and adaptive gains are found to converge to a bounded residual set. In the case of full state variable feedback, the tracking error residuals can be made as small as desired at the expense of high feedback gains.

26545 (UCRL—91623-Rev.1) High gain adaptive control of decentralized systems. Revision 1. Gavel, D.T.; Siljak, D.D. (Lawrence Livermore National Lab., CA (USA); Santa Clara Univ., CA (USA)). 5 Oct 1984. Contract W-7405-ENG-48. 16p. (CONF-850622—2-Rev.1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85010040.

From American Control conference; Boston, MA, USA (19 Jun 1985).

A decentralized adaptive control scheme is presented for a class of large scale interconnected systems. The scheme has the advantage that in addition to the standard assumption about the uncertainty of the subsystems, the strength of interconnections is assumed unknown, provided certain structural constraints are satisfied. The adaptation gains automatically adjust to levels that assure stability of the overall system.

26546 (UCRL—92312) Transform domain adaptive filtering using a recursive DFT. Clark, G.A.; Soderstrand, M.A.; Johnson, T.G. (Lawrence Livermore National Lab., CA (USA); California Univ., Davis (USA). Signal and Image Processing Lab.). Mar 1985. Contract W-7405-ENG-48. 6p. (CONF-8506105—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85008965.

From International symposium on circuits and systems; Kyoto, Japan (5 Jun 1985).

This paper discusses the use of a recursive DFT (discrete Fourier transform) with frequency-domain adaptive filters. We show that, even though the recursive DFT ordinarily has stability problems when implemented in finite precision arithmetic, it is stable when used with an appropriate numerical roundoff procedure, making it practical for use with frequency-sampling type adaptive filters. 10 refs., 4 figs., 1 tab.

26547 ODEPACK, a systematized collection of ODE solvers. Hindmarsh, A.C. (Lawrence Livermore National Lab., CA). pp 55-64 of Scientific computing. Stepleman, R. (ed). Amsterdam, Netherlands; IMACS/North-Holland Publishing Company (1983). Contract W-7405-ENG-48.

The growing number of good general purpose solvers for initial value problems for ordinary differential equation (ODE) systems has fueled discussions on the idea of a systematized collection of such solvers, ODEPACK. Within recent years, a tentative user interface standard was developed, and an initial collection of five solvers was written. These solvers handle stiff and nonstiff problems in standard (explicit) form, problems in linearly implicit form, full Jacobians, banded Jacobians, general sparse Jacobians, and problems with rootfinding (g-stop) requirements. Two of the solvers have automatic (stiff/nonstiff) method selection. These solvers are described briefly here, and their capabilities are illustrated with an example problem arising from a model of atmospheric kinetics-transport in two dimensions. 31 references, 3 tables.

26548 Non-stiff adaptive moving node techniques. Madsen, N.K. (Lawrence Livermore National Lab., CA). pp 19-27 of Scientific computing. Stepleman, R. (ed.). Amsterdam, Netherlands; IMACS/North-Holland Publishing Company (1983). Contract W-7405-ENG-48.

Non-stiff adaptive moving node techniques for solving partial differential equations are considered. The techniques are easy to implement, computationally inexpensive, easy to understand, and widely applicable. Numerical results for several wave propagation problems are presented. 5 references, 4 figures.

26549 Identification of continuous time systems: an application of Ljung's corrected extended Kalman filter. Gavel, D.T.; Azevedo, S.G. (Lawrence Livermore National Lab., CA). pp 1329-1333 of IFAC identification and system parameter estimation 1982. Bekey, G.A.; Saridis, G.N. (eds.). Oxford, England; Pergamon Press (1982). Contract W-7405-ENG-48.

The extended Kalman filter (EKF) has often been used as a parameter identifier for linear systems. Ljung has proposed a correction to the EKF that would allow the algorithm to asymptotically converge to unbiased parameter estimates. In this paper a continuous-discrete version of the algorithm is presented and found to have similar convergence properties. Discussion of the advantages of using continuous time models follows. Also included is a discussion of the computer methods used to propagate the differential equations found in the algorithm.

26550 (CE-Trans—7971) Microcomputer - controlled statistics analyzer. Schoenberger, W.; Urbanski, K.; Wahrburg, J. Translated from *Messen + Pruefen ;* 373-376(May 1979). 11p. NTIS (US Sales Only), PC A02. File Number DE85901112. DE85901112

The statistics analyzer described provides for simultaneous on-line analysis and calculation of statistical parameters of three parallel randomly fluctuating measured values.

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REFER ALSO TO CITATION(S) 23254

28551 (CONF-8406139—) Role of data in scientific progress: proceedings of the ninth international CODATA conference. Glaeser, P.S. (ed.). (Committee on Data for Science and Technology (CODATA), Paris (France)). 1984. 522p. NTIS (US Sales Only), PC A22/MF A01. File Number DE85901178.

From 9. international CODATA conference; Jerusalem, Israel (24 Jun 1984).

Section headings in the proceedings include data in geology and geochemistry, data for oceanography and ecology, data for chemical engineering, data on materials properties, data for energy systems, data base design and management, and data retrieval and library systems. (GHT)

28552 (DOE/AL/26034—T1) Study for establishment of the Rio Grande Communications Network connecting federal, state and private facilities in New Mexico. Heflin, W.H. (New Mexico Technet, Inc., Albuquerque (USA)). 30 Apr 1985. Contract FG04-84AL26034. 46p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85010667.

Prime objective of NMT Inc. is the facilitation of technological transfer out of the Federal Laboratories at Sandia and Los Alamos to the universities and private sector companies, thereby attracting additional high-technology company programs to locate within the Rio Grande Research Corridor. This was to be done by NMT Inc.'s owning and operating the Rio Grande Communication Network (RGCN). The first interface requirements for the proposed first service offering of electronic mail have been outlined.

CORPORATE AUTHOR INDEX

In the Corporate Author Index, report literature is indexed using the name of the organization or institution responsible for issuing the report. Headings are provided for all report literature and for published literature for which a corporate approach is especially desirable, e.g., symposium and conference proceedings.

Each entry under a corporate heading gives the document title and the volume and abstract numbers. The document type, e.g., R for Report; country of publication, e.g., US; and language of the document, e.g., In German, are given in parentheses at the end of the entry. If no language statement appears, the language is English. Tables of document types and country of publication codes appear after the indexes.

DOE Energy Data Base: Corporate Author Entries (DOE/TIC-4585) is used in the standardization of corporate entries. DOE/TIC-4585 is available for purchase from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, Virginia 22161.

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AEG-Telefunken Anlagentechnik, Wedel (Germany, F.R.). Fachbereich Raumfahrt, Neue Technologien
Space know-how in electrical systems, 10:25420 (R;DE)

Aerodyne Research, Inc., Billerica, MA (USA). Center for Chemical and Environmental Physics
Chemical effect of entrained particles in coal conversion streams. 7th quarterly technical progress report, February 1-April 30, 1983, 10:25198 (R;US)
Chemical effect of entrained particles in coal conversion streams. 8th and 9th quarterly technical progress report, 1 May-31 October 1983, 10:25200 (R;US)

Aerojet Energy Conversion Co., Sacramento, CA (USA)
Advanced atmospheric fluidized-bed combustion design. Final report, 10:25205 (R;US)

Aeronautical Systems Div., Wright-Patterson AFB, OH (USA)
Controlled fusion for space propulsion. Report for April 1961-June 1962, 10:26298 (R;US)

Aerospace Corp., El Segundo, CA (USA). Chemistry and Physics Lab.
Nickel-cadmium battery cell reversal from resistive-network effects. Technical report, 10:25661 (R;US)

Aerospace Corp., El Segundo, CA (USA). Space Sciences Lab.
Principles of magnetospheric ion composition. Technical report, 10:26287 (R;US)

Air Force Aeronautical Systems Div., Wright-Patterson AFB, OH (USA)
Mission analysis for controlled fusion propulsion system. Report for 1 February-May 1962, 10:26297 (R;US)

Air Force Geophysics Lab., Hanscom AFB, MA (USA)
Application of GPS in a high precision engineering survey network, 10:26004 (R;US)

Air Products and Chemicals, Inc., Allentown, PA (USA)
Study of the kinetics of hydrogenation using aged catalysts. Quarterly technical progress report, 1 October 1984-31 December 1984, 10:25119 (R;US)

Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung
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Alabama Univ., Huntsville (USA). Dept. of Chemical Engineering
Direct coal liquefaction using iron-titanium hydride as a hydrogen distribution and catalytic material. Quarterly report No. 2, December 1, 1984-February 28, 1985, 10:25125 (R;US)

Alabama Univ., Huntsville (USA). Kenneth E. Johnson Environmental and Energy Center
Biomass feasibility study for Tennessee, Indiana, and Kansas Army Ammunition Plants, 10:25400 (R;US)

Alabama Univ., University (USA). School of Mines and Energy Development
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Low-viscosity lignite slurries and suspensions. Final report, 1983-1984, 10:25196 (R;US)
Vapor-liquid equilibria for coal liquids by gas chromatography. Final report, 1983-1984, 10:25131 (R;US)

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Combined finite element meshing techniques using SUPERTAB. Final report, 10:26527 (R;US)
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Using MATHLIB on the IBM computer and sundry plotting examples with a taste of IMSL, 10:26528 (R;US)

AMAX Extractive Research and Development, Inc., Golden, CO (USA)
Preparation and analyses of low-rank coals for combustion applications. First quarterly report, October 1, 1984-December 31, 1984, 10:25189 (R;US)
Ultra-fine coal characterization. 3rd quarterly report, September 1, 1984-November 30, 1984, 10:25193 (R;US)

American Council for an Energy Efficient Economy, Berkeley, CA
What works: documenting energy conservation in buildings, 10:25732 (R;US)

American Inst. of Physics, New York
Solar neutrinos and neutrino astronomy. AIP conference proceedings No. 126, 10:26257 (R;US)

American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, GA
Building industry roundtable on technology transfer and research utilization: proceedings, 10:25763 (R;US)

Ames Lab., IA (USA)
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Hydrodesulfurization catalysis by Chevrel phase compounds, 10:25890 (R;US)

Amity Foundation, Eugene, OR (USA)
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Determining peak stress history using acoustic emissions, 10:25862 (R;US)

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Site handbook: data acquisition system information, Princeton Professional Park, Princeton, NJ, 10:25736 (R;US)
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The notations in the final parentheses indicate the type of document, e.g., R for Report; the country of publication, e.g., US; and the language if other than English, e.g., In German. Tables of document types and country of publication codes appear after the indexes.

The title may be supplemented with additional words, or a phrase, if it appears additional information would be helpful. In cases for which the title contains little or no information related to the subject entry, it may be replaced entirely by the supplementary information. A qualifier is not always required, and in such cases the title will follow the unqualified subject descriptor.

The descriptors selected for use as subject terms are generally the names of specific materials, things, or processes. To the extent possible, a qualifier is selected to describe the properties of, or processes applied to, the subject term.

Index entries are selected to indicate the important ideas and concepts presented in a document, rather than words that may appear in the text. Within the available thesaurus terms, the most probable or logical place to look for typical information is selected. "See references" are included to guide users from synonymous terms or phrases to the descriptor selected as a subject heading for the concept (e.g., Pipeline Quality Gas, see HIGH BTU GAS). "See also references" are used to indicate where to find references to subject concepts that are narrower, broader, or related to a particular subject heading. To complete an exhaustive search of a given subject, all such headings should be reviewed. Copies of DOE/TIC-7000, the Subject Thesaurus, are available from the National Technical Information Service (NTIS), U.S. Department of Commerce, Springfield, VA 22161.

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AC07-83ID12488	**Operations Engineering, Inc., Fremont, CA (USA)**	
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AC08-81NV10174	**Louisiana Geological Survey, Baton Rouge (USA)**	
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AC08-82DP40152	**KMS Fusion, Inc., Ann Arbor, MI (USA)**	
	10:26458	DOE/DP/40152—T7
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AC08-83NV10282	**EG and G Energy Measurements, Inc., Las Vegas, NV (USA)**	
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AC08-84NV10322	**Fenix and Scisson, Inc., Mercury, NV (USA)**	
	10:26220	DOE/NV/10322—1
	10:26221	DOE/NV/10322—2
	10:26222	DOE/NV/10322—3
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AC09-76SR00001	**Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant**	
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AC11-76PN00014	**Bettis Atomic Power Lab., West Mifflin, PA (USA)**	
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AC15-76CL11200	**Stoller (S.M.) Corp., New York (USA)**	
	10:25576	DOE/CL/11200—T7
AC15-76CL98004	**Buras and Roe, Inc., Oradell, NJ (USA)**	
	10:25577	DOE/CL/98004—31
	10:25617	DOE/CL/98004—29
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AC18-84FC10623	**AMAX Extractive Research and Development, Inc., Golden, CO (USA)**	
	10:25189	DOE/FC/10623—1775
AC21-80ET15020		
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AC21-81MC14521	**EG and G/Washington Analytical Services Center, Inc., Morgantown, WV (USA)**	
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AC21-81MC16244	**Aerodyne Research, Inc., Billerica, MA (USA). Center for Chemical and Environmental Physics**	
	10:25198	ARI-RP—147
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AC21-82MC19077	**Pacific Northwest Labs., Richland, WA (USA)**	
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AC21-82MC19122	**Westinghouse Electric Corp., Madison, PA (USA). Synthetic Fuels Div.**	
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AC21-82MC19210	**General Electric Co., Schenectady, NY (USA). Corporate Research and Development Center**	
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AC21-82MC19314	**Mississippi State Univ., Mississippi State (USA). MHD Energy Center**	
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AC21-82MC19326	**Aerojet Energy Conversion Co., Sacramento, CA (USA)**	
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AC21-83FE60338	**United Technologies Corp., South Windsor, CT (USA). Power Systems Div.**	
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AC21-83MC20212	**Institute of Gas Technology, Chicago, IL (USA)**	
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AC21-83MC20400	**Mueller Associates, Inc., Baltimore, MD (USA)**	
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AC21-84MC21225	**Institute of Gas Technology, Chicago, IL (USA)**	
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AC22-76ET10532	**Chevron Research Co., Richmond, CA (USA)**	
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AC22-79PC20080	**Pittsburgh Univ., PA (USA)**	
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AC22-80PC30027	**Conoco, Inc., Library, PA (USA). Coal Research Div.**	
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AC22-81PC40077	**Union Carbide Corp., Tarrytown, NY (USA). Tarrytown Technical Center**	
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AC22-81PC40785	**SRI International, Menlo Park, CA (USA)**	
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AC22-81PC41760	**Univ. of Kentucky, Lexington**	
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	10:25113	DOE/PC/50030—T6
	10:25114	DOE/PC/50030—T7
	10:25115	DOE/PC/50030—T8
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AC22-82PC50270	**TRW, Inc., Redondo Beach, CA (USA)**	
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AC22-83PC60045	**Battelle Columbus Labs., OH (USA)**	
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AC22-84PC70815	**TRW Space and Technology Group, Redondo Beach, CA (USA)**	
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AC22-84PC72007	**AMAX Extractive Research and Development, Inc., Golden, CO (USA)**	
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AC22-84PC72008	**TRW Energy Development Group, Redondo Beach, CA (USA)**	
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AI01-77CS51040	**IIT Research Inst., Chicago, IL (USA)**	
	10:25804	0DOE/NASA—0006-2
AI01-81CS66001	**Jet Propulsion Lab., Pasadena, CA (USA)**	
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AI05-83ER40117	**Plasma Theory Branch, Plasma Physics Division, U.S. Naval Research Laboratory, Washington, DC 20375-**	
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AI08-79DP40092	**JAYCOR, Alexandria, VA (USA)**	
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AS05-80ER10749	**Arkansas Univ., Fayetteville (USA). Dept. of Physics**	
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AS05-82ER53134	**Department of Physics, Auburn University, Alabama 36849**	
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AS05-83ER45031	**Florida Univ., Gainesville (USA)**	
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AS08-84DP40192	**Maryland Univ., College Park (USA). Lab. for Plasma and Fusion Energy Studies**	
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FC01-83MI10024	**Howard Univ., Washington, DC (USA)**	
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FC07-80ID12121	**Brown and Root Development, Inc., Houston, TX (USA)**	
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FC21-83FE60177	**Western Research Inst., Laramie, WY (USA)**	
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FC22-83FE60339	**Southern Illinois Univ., Carbondale (USA). Coal Extraction and Utilization Research Center**	
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FG01-79RG10219	**Ohio Public Utilities Commission, Columbus (USA)**	
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FG01-80RA50380	**Republic of Texas Coal Co., Houston (USA)**	
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FG01-81EI10314	**Maine Office of Energy Resources, Augusta (USA)**	
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FG01-84CE90144	**Wiley (John) and Sons, New York (USA)**	
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FG02-84ER40158	**Harvard Univ., Cambridge, MA (USA). Div. of Applied Sciences**	
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FG06-80R000470	**Faith Lutheran Evangelical Church, Caldwell, ID (USA)**	
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FG06-80R000498	**Lopez Energy Alternatives, WA (USA)**	
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FG06-80R000510	**Fugate (Sandra), Seattle, WA (USA)**	
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FG06-81R001324	**Amity Foundation, Eugene, OR (USA)**	
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FG22-82PC50797	California Univ., Riverside (USA). Dept. of Chemistry	
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FG22-82PC50800	Illinois Univ., Urbana (USA). Dept. of Chemistry	
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FG22-83PC60778	SRI International, Menlo Park, CA (USA)	
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FG22-83PC60779	Signal UOP, Inc., Des Plaines, IL (USA). Research Center	
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FG22-83PC60783	Air Products and Chemicals, Inc., Allentown, PA (USA)	
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FG22-83PC60787	Oklahoma State Univ., Stillwater (USA). School of Chemical Engineering	
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FG22-83PC60798	Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Chemical Engineering	
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FG22-83PC60800	Brown Univ., Providence, RI (USA). Div. of Engineering	
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FG22-83PC60804	Oklahoma Univ., Norman (USA). School of Chemical Engineering and Materials Science	
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FG22-84PC70794	Stanford Univ., CA (USA). High Temperature Gasdynamics Lab.	
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FG43-79R306099	Freeman (Lisa H.), Malvern, PA (USA)	
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FG43-79R306118	Ona Junior High School, WV (USA)	
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FG43-79R306121	Dynamic Flow, Inc., Morgantown, WV (USA)	
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FG43-80R302404	Gerwin (Harry L.), Silver Spring, MD (USA)	
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FG43-80R302422	Nichols (N. Shannon II), Meshoppen, PA (USA)	
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FG43-80R302423	Corra (John P.), Yardley, PA (USA)	
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FG43-80R302428	Pennsylvania State Univ., University Park (USA)	
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FG43-80R302431	Malmros (Mark K.), Washington Crossing, PA (USA)	
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FG43-80R302438	Flow Products, Inc., Morgantown, WV (USA)	
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FG43-80R302439	Frech (Gregory M.), Virginia Beach, VA (USA)	
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CONF-810803-	(Topical meeting on reactor safety aspects of fuel behavior, Sun Valley, ID, USA, 2-6 Aug 1981)				
3	NTIS, PC A02/MF A01		TI85004742	MN -78	10:25609
CONF-810986-	(Meeting of the division of particles and fields of the American Physical Society, Santa Cruz, CA, USA, 9-11 Sep 1981)				
	AIP Conf. Proc., No. 81, 433-460(1982)				10:25976
	AIP Conf. Proc., No. 81, 61-84(1982)				10:26332
	AIP Conf. Proc., No. 81, 163-172(1982)				10:26333
	AIP Conf. Proc., No. 81, 199-226(1982)				10:26334
	AIP Conf. Proc., No. 81, 280-302(1982)				10:26335
	AIP Conf. Proc., No. 81, 186-198(1982)				10:26336
	AIP Conf. Proc., No. 81, 461-479(1982)				10:26337
	AIP Conf. Proc., No. 81, 480-495(1982)				10:26338
	AIP Conf. Proc., No. 81, 303-311(1982)				10:26346
	AIP Conf. Proc., No. 81, 85-96(1982)				10:26347
	AIP Conf. Proc., No. 81, 238-244(1982)				10:26348
	AIP Conf. Proc., No. 81, 173-185(1982)				10:26358
	AIP Conf. Proc., No. 81, 316-374(1982)				10:26359
	AIP Conf. Proc., No. 81, 522-537(1982)				10:26360
	AIP Conf. Proc., No. 81, 538-547(1982)				10:26361

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CONF-811042-	(9. water reactor safety research information meeting, Washington, DC, USA, 26-28 Oct 1981)			
9	NTIS, PC A02/MF A01	TI85004511	MN -78	10:25544
10	NTIS, PC A02/MF A01	TI85004515	MN -78	10:25610
CONF-820330-	(International symposium on quantum chemistry, theory of condensed matter, and propagator methods in the quantum theory of matter, Flagler Beach, FL, USA, 1-13 Mar 1982)			
	Int. J. Quant. Chem., Symp., No. 16, 33-48(1982)			10:26325
	Int. J. Quant. Chem., Symp., No. 16, 49-61(1982)			10:26450
	Int. J. Quant. Chem., Symp., No. 16, 167-181(1982)			10:26451
CONF-820359-	(Western regional American Nuclear Society student conference, Corvallis, OR, USA, 28-30 Mar 1982)			
Abstr.	*See* DOE/ER/10275-1A	DE83004080	MN -2	10:26101
CONF-8205275-	(Meeting on potential applications of fluidized bed combustion in Canadian industry, Calgary, Canada, 27 May 1982)			
	NTIS (US Sales Only), PC A09/MF A01; 1	DE84901602	MN -90c	10:25203
CONF-820655-	(Health Physics Society annual meeting, Las Vegas, NV, USA, 27 Jun-1 Jul 1982)			
14	*See* PNL-SA-10181	TI85007428	MN -80	10:25651
CONF-8206132-	(Nuclear reaction mechanism conference, Varenna, Italy, 14-19 Jun 1982)			
3	*See* IFUSP-P-335	DE85700556	MN -34C	10:26399
CONF-820849-	(Summer study in energy efficient buildings, Santa Cruz, CA, USA, 22-28 Aug 1982)			
	NTIS, PC A25/MF A01; 1 (GPO Dep.)	E 1.99: DE84014927	MN -95d	10:25732
CONF-830286-	(Symposium on remote sensing technology, Las Vegas, NV, USA, 23-25 Feb 1983)			
	See EGG/10282-1057	E 1.99: DE85010212	MN -2	10:26023
CONF-830289-	(Workshop on sampling and analysis of utility pollutants, Los Angeles, CA, USA, 8-9 Feb 1983)			
	See EPRI-CS-3921	TI85920589	ND -90i	10:25161
CONF-8303106-	(16. Essen meeting on sewage sludge - raw material or pollutant, Essen, F.R. Germany, 9-11 Mar 1983)			
	NTIS (US Sales Only), PC A99/MF A01; 1	DE85770201	MN -95e	10:25772
CONF-830437-	(ASME international conference on wear of materials, Reston, VA, USA, 11-14 Apr 1983)			
4	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85010618	MN -25	10:25797
CONF-8305103-	(COMPUMAG conference on the computation of electromagnetic fields, Genoa, Italy, 30 May-2 Jun 1983)			
3	*See* JINR-R-9-83-90	DE85700605	MN -28	10:25981
CONF-8306261-	(3. IWL forum on current problems and tasks of environmental policy, Koeln, F.R. Germany, 21 Jun 1983)			
	NTIS (US Sales Only), PC A03/MF A01; 1	DE85770203	MN -11	10:26087
CONF-8306266-	(16. annual meeting of the Society for Epidemiologic Research, Winnipeg, Manitoba, Canada, 15-17 Jun 1983)			
	Am. J. Epidemiol., 120: No. 3, 358-369(Sep 1984)			10:26207
CONF-830718-	(International Europhysics conference on high energy physics, Brighton, UK, 20-27 Jul 1983)			
33	*See* RL-83-074	DE85700611	MN -37	10:26015
CONF-8307150-	(2. EPRI workshop on support-structure corrosion in nuclear plant steam generators, Seattle, WA, USA, 18-20 Jul 1983)			
	See EPRI-NP-3924-SR	TI85920567	ND -78	10:25564
CONF-830874-	(27. annual technical symposium of the Society of Photo-Optical Instrumentation Engineers (SPIE), San Diego, CA, USA, 21-26 Aug 1983)			
33	*See* UCRL-89362	E 1.99: DE85005515	MN -38	10:25924
CONF-8308116-	(Workshop on the electrochemistry of carbon, Cleveland, OH, USA, 17-19 Aug 1983)			
	Proc. - Electrochem. Soc., 84-5: 344-362(Aug 1983)			10:25666
	Proc. - Electrochem. Soc., 84-5: 238-250(Aug 1983)			10:25667
	Proc. - Electrochem. Soc., 84-5: 123-157(Aug 1983)			10:25668
CONF-8309223-	(1. international workshop on carcinogenic and/or mutagenic metals, Geneva, Switzerland, 11-14 Sep 1983)			
	Toxicol. Environ. Chem. Rev., 8: No. 4, 235-252(1984)			10:26209
CONF-831112-	(Coal technology '83 - international coal utilization convention, Houston, TX, USA, 15-17 Nov 1983)			
	Coal Technol. (Houston), 5: 125-138(Nov 1983)			10:25142
	Coal Technol. (Houston), 6: 235-262(Nov 1983)			10:25167
	Coal Technol. (Houston), 1: 21-34(Nov 1983)			10:25219
CONF-8311208-	(2. seminar on countermeasures for pipe cracking in BWRs, Palo Alto, CA, USA, 15-18 Nov 1983)			
Vol.1	*See* EPRI-NP-3684-SR-Vol.1	TI85920101	ND -78	10:25537
CONF-840193-	(Workshop on cryogenics for the superconducting super collider, Upton, NY, USA, 17-19 Jan 1984)			
Summ.	*See* BNL-35842	E 1.99: DE85010951	MN -28	10:25972

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CONF-840264-	(Workshop on high energy excitations in condensed matter, Los Alamos, NM, USA, 13-15 Feb 1984)			
Vol.1	*See* LA-10227-C-Vol.1	E 1.99: DE85007396	STD -34	10:26416
Vol.2	*See* LA-10227-C-Vol.2	E 1.99: DE85007395	STD -34	10:26310
CONF-8402139-	(Argonne workshop on programming the next generation of supercomputers, Albuquerque, NM, USA, 27-28 Feb 1984)			
	See ANL/MCS-TM-34	E 1.99: DE85008348	MN -32	10:26524
CONF-840395-	(Workshop on semi-classical methods in nuclear physics, Grenoble, France, 5-8 Mar 1984)			
	J. Phys. (Paris), Colloq., 45: 143-152(Jun 1984)			10:26414
CONF-8403124-	(Sanibel symposia, Palm Coast, FL, USA, 1-15 Mar 1984)			
Pt.1	NTIS, PC A99/MF A01; 1 (GPO Dep.)	E 1.99: DE85009401	MN -4	10:26303
CONF-8404190-	(Werner-Brandt workshop on penetration phenomena: inelastic near-surface interactions, Oak Ridge, TN, USA, 12-13 Apr 1984)			
	NTIS, PC A19/MF A01; 1 (GPO Dep.)	E 1.99: DE85010579	MN -34	10:26306
CONF-840570-	(American Society for Metals materials for future energy systems conference, Washington, DC, USA, 1-3 May 1984)			
	Mater. Compon. Fossil Energy Appl., No. 54, 5-8(1 Feb 1985)			10:25138
CONF-8405224-	(Workshop on atmospheric tracers, Santa Fe, NM, USA, 21-25 May 1984)			
	See LA-10301-C	E 1.99: DE85010573	STD -11	10:26075
CONF-8405303-	(Workshop on spectral theory of Sturm-Liouville differential operators, Argonne, IL, USA, 14 May-15 Jun 1984)			
	See ANL-84-73	E 1.99: DE85009893	STD -32	10:26452
CONF-8406139-	(9. international CODATA conference, Jerusalem, Israel, 24-28 Jun 1984)			
	NTIS (US Sales Only), PC A22/MF A01; 1	DE85901178	MN -32	10:26551
CONF-8407119-	(47. annual Meteoritical Society meeting, Albuquerque, NM, USA, 30 Jul-2 Aug 1984)			
	See N-85-15599			10:26267
	See N-85-15600			10:26268
	See N-85-15607			10:26269
	See N-85-15615			10:26270
	See N-85-15631			10:26271
	See N-85-15633			10:26273
	See N-85-15634			10:26274
	See N-85-15635			10:26275
	See N-85-15636			10:26276
	See N-85-15637			10:26277
	See N-85-15643			10:26278
	See N-85-15647			10:26279
CONF-8407121-	(5. international symposium on surfactants in solution, Bordeaux, France, 9-13 Jul 1984)			
2	*See* SAND-84-2606C	E 1.99: DE85010093	MN -4	10:25881
CONF-840804-	(Intersociety energy conversion engineering conference, San Francisco, CA, USA, 19-24 Aug 1984)			
56	*See* SERI/TP-211-2378	E 1.99: DE85008800	MN -63	10:25433
CONF-840828-	(International synfuels policies and technologies symposium, Philadelphia, PA, USA, 19-22 Aug 1984)			
	AIChE Natl. Meet., No. 14C, 25(Aug 1984)			10:25227
	AIChE Natl. Meet., No. 2D, 21(Aug 1984)			10:25258
	AIChE Natl. Meet., No. 18D, 14(Aug 1984)			10:25399
CONF-8408132-	(Conference on solar neutrinos and neutrino astronomy, Lead, SD, USA, 23-25 Aug 1984)			
	American Inst. of Physics, 335 E. 45th St., New York, NY 10017	TI85007006	ND -34B	10:26257
CONF-8408155-	(Energy week 1984, Zurich, Switzerland, 27-29 Aug 1984)			
Pt.1	NTIS (US Sales Only), PC A04/MF A01	DE85770272	MN -13	10:25692
Pt.2	NTIS (US Sales Only), PC A04/MF A01	DE85770273	MN -13	10:25693
Pt.3	NTIS (US Sales Only), PC A04/MF A01	DE85770274	MN -13	10:25694
CONF-840913-	(Conference on structural engineering in operating nuclear facilities, Raleigh, NC, USA, 10-12 Sep 1984)			
7	*See* DOE/CL/98004-29	E 1.99: DE85009031	MN -79h	10:25617
8	*See* DOE/CL/98004-34	E 1.99: DE85009032	MN -79h	10:25618
CONF-840937-	(Applied superconductivity conference, San Diego, CA, USA, 9-13 Sep 1984)			
30	*See* LBL-18704	E 1.99: DE85010979	MN -25	10:25918
CONF-840938-	(State-of-the-art in computational mathematics, Argonne, IL, USA, 20-21 Sep 1984)			
Summa.	*See* ANL/MCS-TM-42	E 1.99: DE85008122	MN -32	10:26525
CONF-8409163-	(Workshop on coherent and collective propagation of relativistic E-beams and electromagnetic radiation, Villa Olmo, Como, Italy, 13-16 Sep 1984)			
5	*See* BNL-36172	E 1.99: DE85010547	MN -28	10:25977
CONF-8409178-	(Conference on large scale fire phenomenology, Gaithersburg, MD, USA, 10-13 Sep 1984)			
2	*See* LBL-19166	E 1.99: DE85009930	MN -11	10:26076

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CONF-8409183-	(9. Canadian symposium on catalysis, Quebec, Canada, 30 Sep-3 Oct 1984)				
	Stud. Surf. Sci. Catal., 19: 439-455(Sep 1984)				10:25398
CONF-8409209-	(International symposium on rare earths spectroscopy, Wroclaw, Poland, 10 Sep 1984)				
2	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85010272	MN -4	10:25900
CONF-8409210-	(Texas A and M symposium on theory and modeling for materials design, College Station, TX, USA, 17-19 Sep 1984)				
2	*See* LBL-19362	E 1.99:	DE85011167	MN -25	10:25861
CONF-8409222-	(5. international ocean disposal symposium, Corvallis, OR, USA, 10-14 Sep 1984)				
1	*See* GKSS-84/E/54		DE85751613	MN -11	10:26072
CONF-8409228-	(Midwest solid state theory symposium, Minneapolis, MN, USA, 6-8 Sep 1984)				
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85010265	MN -25	10:26437
CONF-8409229-	(CECAM workshop transport, interactions and instabilities in laser-plasmas, Orsay, France, 24 Sep-5 Oct 1984)				
1	*See* LA-UR-85-1119	E 1.99:	DE85009605	MN -21	10:26462
CONF-841043-	(37. Pacific Coast regional meeting of the American Ceramic Society, San Francisco, CA, USA, 28-31 Oct 1984)				
	Mater. Compon. Fossil Energy Appl., No. 54, 1-4(1 Feb 1985)				10:25137
CONF-841073-	(Electric vehicle contractors' coordination meeting, Las Vegas, NV, USA, 23-25 Oct 1984)				
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85007991	MN -94cb	10:25663
CONF-8410142-	(12. water reactor safety research information meeting, Gaithersburg, MD, USA, 23-26 Oct 1984)				
81	*See* EGG-M-24384	E 1.99:	DE85006378	MN -78	10:25621
CONF-8410156-	(Fall meeting of the Western States Section of the Combustion Institute, Stanford, CA, USA, 22-23 Oct 1984)				
6	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010118	MN -93	10:25244
CONF-8410167-	(Scrap tire fuel for cement kilns, Chicago, IL, USA, 2 Oct 1984)				
Summ.	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85011259	MN -95f	10:25766
CONF-8410222-	(American Physical Society meeting, Santa Fe, NM, USA, 31 Oct-3 Nov 1984)				
20	*See* FNAL/C-85/36	E 1.99:	DE85010141	MN -34D	10:26327
CONF-8410224-	(AIP conference on neutrino mass and gauge structure of weak interaction, Cable, WI, USA, 24-27 Oct 1984)				
5	*See* LA-UR-85-1439	E 1.99:	DE85010739	MN -34C	10:26412
CONF-8410237-	(Workshop on atomic spectra and collisions in external fields, Gaithersburg, MD, USA, 22-23 Oct 1984)				
3	*See* BNL-36165	E 1.99:	DE85010550	MN -34A	10:26300
CONF-8411140-	(ARO workshop on new computing environments: parallel, vector and systolic, Stanford, CA, USA, 7-9 Nov 1984)				
4	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85010263	MN -32	10:26530
CONF-8411153-	(International conference on lasers '84, San Francisco, CA, USA, 26-30 Nov 1984)				
4	*See* LA-UR-85-1460	E 1.99:	DE85010736	MN -34	10:25988
CONF-8411156-	(Workshop on identifying the barriers to commercialization of low BTU-gasifiers, Atlanta, GA, USA, 27-28 Nov 1984)				
	See PNL-SA-13123	E 1.99:	DE85011183	MN -61F	10:25389
CONF-8411160-	(Workshop on the source term for radionuclide migration from HLW or spent nuclear fuel, Albuquerque, NM, USA, 13-15 Nov 1984)				
1	*See* UCRL-91257	E 1.99:	DE85009952	MN -70	10:25324
2	*See* SAND-84-2547C	E 1.99:	DE85010090	MN -70	10:25313
CONF-8411161-	(SQUID magnetometry workshop, Berkeley Springs, WV, USA, 12-14 Nov 1984)				
1	*See* LBL-19013	E 1.99:	DE85009942	MN -37	10:25920
CONF-841235-	(International symposium on lanthanide-actinide separations, Honolulu, HI, USA, 16-22 Dec 1984)				
1	*See* LA-UR-85-1471	E 1.99:	DE85010732	MN -10	10:25813
CONF-841245-	(Geochemistry of radionuclides migration, Argonne, IL, USA, 3-6 Dec 1984)				
2	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010293	MN -70	10:26255
CONF-841249-	(Fall DECUS symposium, Anaheim, CA, USA, 10-14 Dec 1984)				
	Digital Equipment Corp., 249 Northboro Rd., BP02, Marlboro, MA 01752		TI85901280	ND -32	10:26529
CONF-841258-	(ASHRAE/DOE round table on technology transfer, Washington, DC, USA, 12 Dec 1984)				
Summ.	*See* PNL-SA-12995	E 1.99:	DE85011348	MN -95d	10:25763
CONF-841265-	(Symposium on new experiments in atomic physics using synchrotron radiation, Lund, Sweden, 13-14 Dec 1984)				
1	*See* BNL-36348	E 1.99:	DE85010960	MN -34A	10:26301

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CONF-850101-	(International congress on hydrology of rocks of low permeability, Tucson, AZ, USA, 7-12 Jan 1985)				
10	*See* RHO-BW-SA-366P	E 1.99:	DE85009752	MN -70	10:26227
CONF-850103-	(2. symposium on space nuclear power systems, Albuquerque, NM, USA, 14-16 Jan 1985)				
9	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85010566	MN -80	10:25798
CONF-850114-	(Joint US/CERN School on Particle Accelerators topical course on non-linear dynamics, Sardinia, Italy, 31 Jan-5 Feb 1985)				
1	*See* LBL-18987	E 1.99:	DE85010982	MN -28	10:26535
CONF-850136-	(23. AIAA aerospace sciences meeting, Reno, NV, USA, 14-17 Jan 1985)				
3	*See* SAND-84-8022	E 1.99:	DE85006289	MN -96	10:25963
CONF-850146-	(Aspen winter physics conference, Aspen, CO, USA, 14-19 Jan 1985)				
5	*See* BNL-36147	E 1.99:	DE85010239	MN -34D	10:26351
6	*See* SLAC-PUB-3582	E 1.99:	DE85010217	MN -34D	10:26003
CONF-850151-	(National Water Well Association Western Regional ground water conference, Reno, NV, USA, 15-16 Jan 1985)				
3	*See* RHO-BW-SA-398AP	E 1.99:	DE85010543	MN -70	10:25309
CONF-850152-	(3. LEAR workshop, Tignes-Savoie, France, 19-26 Jan 1985)				
4	*See* BNL-36234	E 1.99:	DE85010546	MN -34C	10:26382
CONF-850159-	(8. symposium on nuclear physics, Oaxtepec, Mexico, 8-10 Jan 1985)				
2	*See* BNL-36119	E 1.99:	DE85009755	MN -34C	10:26395
CONF-850163-	(Workshop on Dirac approaches to nuclear physics, Los Alamos, NM, USA, 31 Jan-2 Feb 1985)				
2	*See* TRI-PP-85-11		DE85901288	MN -34C	10:26413
CONF-850164-	(FNAL/ANL workshop on charged particle accelerators for cancer therapy, Batavia, IL, USA, 24-25 Jan 1985)				
2	*See* LBL-19033	E 1.99:	DE85011204	MN -28	10:26000
CONF-850165-	(Conference on solitons and coherent structures, Santa Barbara, CA, USA, 11-16 Jan 1985)				
3	*See* LA-UR-85-1055		DE85009626	MN -32	10:26453
4	*See* LA-UR-85-1467	E 1.99:	DE85010733	MN -34	10:26454
CONF-850169-	(7. international conference on positron annihilation, New Delhi, India, 6-11 Jan 1985)				
4	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010287	MN -25	10:25799
5	*See* BNL-36286	E 1.99:	DE85010237	MN -25	10:25794
7	*See* BNL-36287	E 1.99:	DE85010235	MN -25	10:25795
8	*See* BNL-36289	E 1.99:	DE85010238	MN -25	10:25838
9	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010283	MN -25	10:25800
10	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85010507	MN -34A	10:26302
CONF-850170-	(17. International Association of Hydrologists international congress, Tucson, AZ, USA, 7-12 Jan 1985)				
1	*See* RHO-BW-SA-366P	E 1.99:	DE85009752	MN -70	10:26227
2	*See* RHO-BW-SA-372P	E 1.99:	DE85011392	MN -70	10:26228
CONF-850207-	(Geopressured-geothermal energy conference, Austin, TX, USA, 4-6 Feb 1985)				
7	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010426	MN -66a	10:25492
CONF-850241-	(1. national conference on microcomputer applications for conservation and renewable energy, Tucson, AZ, USA, 26-28 Feb 1985)				
1	*See* LA-UR-85-868	E 1.99:	DE85009545	MN -59B	10:25470
CONF-850267-	(2. international conference on ultrastructure processing of ceramics, glasses and composites, Daytona Beach, FL, USA, 25 Feb-1 Mar 1985)				
5	*See* LBL-18586	E 1.99:	DE85009902	MN -59B	10:25860
CONF-850277-	(Chapman conference on solar wind-magnetosphere energy coupling, Pasadena, CA, USA, 12-15 Feb 1985)				
2	*See* LA-UR-85-1305	E 1.99:	DE85010760	MN -34B	10:26294
3	*See* LA-UR-85-1303	E 1.99:	DE85010761	MN -34B	10:26293
CONF-850278-	(5. topical workshop on proton-anti-proton collider physics, St. Vincent, Italy, 25 Feb-1 Mar 1985)				
1	*See* SLAC-PUB-3655	E 1.99:	DE85011433	MN -28	10:26005
CONF-850301-	(12. annual energy technology conference and exposition, Washington, DC, USA, 25-27 Mar 1985)				
6	*See* SERI/TP-251-2660	E 1.99:	DE85008795	MN -59B	10:25764
CONF-850303-	(International symposium on hydrogen in metals, Belfast, Northern Ireland, 26-29 Mar 1985)				
1	*See* BNL-36350	E 1.99:	DE85010961	MN -25	10:25839
CONF-850310-	(6. topical meeting on the technology of fusion energy, San Francisco, CA, USA, 3-7 Mar 1985)				
63	*See* UCRL-92212	E 1.99:	DE85009953	MN -20	10:26516
70	*See* UCRL-92025	E 1.99:	DE85010473	MN -70	10:26515
71	*See* UCRL-92024	E 1.99:	DE85010474	MN -20d	10:26514
72	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85010519	MN -20d	10:26486
73	NTIS, PC A02; 3		DE85010520	MN -20d	10:26487
74	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85010522	MN -20d	10:26488
75	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85010505	MN -20d	10:26489

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76	*See* GA-A-17881	E 1.99: DE85010445	MN -20	10:26505
77	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85010506	MN -20	10:26490
78	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85010488	MN -20b	10:26491
79	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85010489	MN -20f	10:26492
80	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85010490	MN -20b	10:26493
81	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85010491	MN -20d	10:26457
82	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85010504	MN -20d	10:26494
83	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85010564	MN -20	10:26495
84	*See* UCRL-91647	E 1.99: DE85010930	MN -21	10:26512
85	*See* UCRL-92248	E 1.99: DE85010931	MN -21	10:26517
86	*See* UCRL-91589	E 1.99: DE85010933	MN -21	10:26510
89	*See* UCRL-91643	E 1.99: DE85010940	MN -21	10:26511
CONF-850311-	(National Association of Corrosion Engineers annual meeting and materials performance and corrosion show, Boston, MA, USA, 25-29 Mar 1985)			
12	*See* PNL-SA-12464	E 1.99: DE85010305	MN -85	10:25292
CONF-850314-	(Waste management '85, Tucson, AZ, USA, 24-28 Mar 1985)			
53	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85010493	MN -70	10:25321
54	*See* SAND-84-1748C	E 1.99: DE85009835	MN -70	10:25311
57	*See* PNL-SA-12587	E 1.99: DE85010307	MN -85	10:25293
58	*See* PNL-SA-12509	E 1.99: DE85010308	MN -70	10:25308
59	*See* UCRL-92459	TI85010479	MN -71	10:25294
60	*See* MLM-3237(OP)	E 1.99: DE85010808	MN -71	10:25921
CONF-850345-	(Southwest conference on optics, Albuquerque, NM, USA, 4-8 Mar 1985)			
10	*See* LA-UR-85-733	E 1.99: DE85009586	MN -37	10:26024
16	*See* LA-UR-85-1516	E 1.99: DE85010721	MN -37	10:26020
19	*See* UCRL-92262	E 1.99: DE85010475	MN -21	10:26518
20	*See* LA-UR-85-1288	E 1.99: DE85010703	MN -38	10:25938
22	*See* LA-UR-85-1216	E 1.99: DE85010784	MN -37	10:25937
24	*See* UCRL-91737	E 1.99: DE85010925	MN -21	10:26513
CONF-850357-	(Spring national meeting of AIChE, Houston, TX, USA, 24-28 Mar 1985)			
10	*See* LBL-19398	E 1.99: DE85011160	MN -90	10:25518
CONF-850376-	(Symposium on semiclassical descriptions of atomic and nuclear collisions, Copenhagen, Denmark, 25-28 Mar 1985)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85010561	MN -34C	10:26396
CONF-850381-	(Chemistry of coal liquefaction symposium, Sapporo, Japan, 17-20 Mar 1985)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85010648	MN -90	10:25091
CONF-850388-	(Solar buildings: realities for today - trends for tomorrow, Washington, DC, USA, 18-20 Mar 1985)			
3	*See* LA-UR-85-1045	E 1.99: DE85009623	MN -59B	10:25472
5	*See* LA-UR-85-869	E 1.99: DE85009546	MN -59B	10:25471
7	*See* SERI/TP-253-2681	E 1.99: DE85008792	MN -62	10:25479
CONF-8503100-	(ADPA meeting, Hilton Head, SC, USA, 11-13 Mar 1985)			
4	*See* MLM-3236(OP)	E 1.99: DE85010809	MN -45	10:26032
5	*See* MLM-3240(OP)	E 1.99: DE85010805	MN -35	10:26034
7	*See* MLM-3239(OP)	E 1.99: DE85010806	MN -35	10:26033
8	*See* MLM-3241(OP)	E 1.99: DE85010804	MN -45	10:26035
CONF-8503106-	(Amorphous silicon subcontractors annual review meeting, Washington, DC, USA, 21-23 Mar 1985)			
1	*See* BNL-36269	E 1.99: DE85010236	MN -63e	10:25408
CONF-8503120-	(Hadronic probes and nuclear interactions conference, Tempe, AZ, USA, 11-14 Mar 1985)			
2	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85010498	MN -34D	10:26397
CONF-8503127-	(Atomic data workshop, Daresbury, UK, 29-31 Mar 1985)			
1	*See* LA-UR-85-1452	E 1.99: DE85010737	MN -25	10:26311
CONF-8503130-	(Science Applications international conference on free-langrangian methods, Annapolis, MD, USA, 1 Mar 1985)			
1	*See* LA-UR-85-1078	E 1.99: DE85009597	MN -34	10:26323
CONF-850405-	(2. national topical meeting on tritium technology in fission, fusion and isotopic applications, Dayton, OH, USA, 30 Apr-2 May 1985)			
6	*See* EGG-M-20884	E 1.99: DE85008439	MN -20d	10:26504
CONF-850406-	(International symposium and workshop on particulate and multi-phase processes and the 16th annual meeting of the Fine Particle Society, Miami Beach, FL, USA, 22-26 Apr 1985)			
1	*See* LA-UR-85-963	E 1.99: DE85009632	MN -41	10:26057
2	*See* SAND-84-2187C	E 1.99: DE85010388	MN -70	10:25880
4	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85010510	MN -11	10:26061
5	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85010248	MN -79	10:25611
CONF-850410-	(ANS/ENS fast reactor safety meeting, Knoxville, TN, USA, 21-24 Apr 1985)			
24	NTIS, PC A02/MF A01	DE85005043	MN -79p	10:25612
30	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85010262	MN -79	10:25594
33	*See* LA-UR-85-1368	E 1.99: DE85010798	MN -79p	10:25628
34	*See* LA-UR-85-1374	E 1.99: DE85010782	MN -79p	10:25629

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37	*See* LA-UR-85-1341	E 1.99:	DE85010803	MN -79p	10:25627
CONF-850411-	(International meeting on advances in nuclear engineering computational methods, Knoxville, TN, USA, 9-11 Apr 1985)				
11	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010687	MN -20	10:26496
CONF-850412-	(6. symposium on the training of nuclear facility personnel, Nashville, TN, USA, 15-18 Apr 1985)				
	NTIS, PC A13/MF A01; 1 (GPO Dep.)	E 1.99:	DE85010098	MN -2	10:25531
CONF-850415-	(4. international conference on wear of materials, Vancouver, Canada, 14-18 Apr 1985)				
4	*See* LBL-17632	E 1.99:	DE85010988	MN -25	10:25814
CONF-850417-	(189. national meeting of the American Chemical Society, Miami, FL, USA, 28 Apr-3 May 1985)				
17	*See* DP-MS-84-130	E 1.99:	DE85010224	MN -4	10:25901
CONF-850419-	(21. annual meeting of the National Council on Radiation Protection and Measurements, Washington, DC, USA, 3-4 Apr 1985)				
2	*See* SAND-85-0801C	E 1.99:	DE85009838	MN -70	10:25314
CONF-850421-	(2. spring meeting of the Materials Research Society, San Francisco, CA, USA, 15-18 Apr 1985)				
3	*See* PNL-SA-12738	E 1.99:	DE85010973	MN -25	10:25841
4	*See* SAND-84-2136C	E 1.99:	DE85011193	MN -25	10:25952
CONF-850428-	(8. DOE Computer Security Group conference, Richland, WA, USA, 16-18 Apr 1985)				
2	*See* SAND-85-0530C	E 1.99:	DE85010121	MN -32	10:26538
CONF-850444-	(Newer coal technologies: implications for energy and development policies in Asia and the Pacific, Honolulu, HI, USA, 17-24 Apr 1985)				
2	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85010565	MN -90e	10:25202
CONF-850453-	(Workshop on neutron therapy: low dose rate and beam radiation therapy, Lexington, KY, USA, 24-27 Apr 1985)				
1	*See* DP-MS-85-26	E 1.99:	DE85010223	MN -48	10:25902
CONF-850471-	(Workshop on methods for assessing the off-site radiological consequences of nuclear accidents, Luxembourg, Luxembourg, 15-19 Apr 1985)				
2	*See* SAND-85-0885C		TI85010387	MN -80	10:25652
CONF-850473-	(Seminar on the speciation of fission products in the environment, Oxford, UK, 16-19 Apr 1985)				
2	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010266	MN -11	10:26123
CONF-850489-	(Distributed receiver solar thermal technology conference, Albuquerque, NM, USA, 24-25 Apr 1985)				
Summs.	*See* SAND-84-2454	E 1.99:	DE85010551	STD -62	10:25452
CONF-8504102-	(66. AWS annual meeting, Las Vegas, NV, USA, 28 Apr-3 May 1985)				
2	*See* DP-MS-84-81	E 1.99:	DE85010064	MN -38	10:25806
CONF-8504104-	(Meeting of the Society of Manufacturing Engineers (CIMCOM '85), Anaheim, CA, USA, 16-18 Apr 1985)				
1	*See* Y/DX-631	E 1.99:	DE85010047	MN -38	10:25912
CONF-8504107-	(35. national conference on nuclear spectroscopy and structure of atomic nuclei, Leningrad, USSR, 16-19 Apr 1985)				
1	*See* UCRL-92439	E 1.99:	DE85010476	MN -34C	10:26393
CONF-8504108-	(Interex/HP-1000 Users conference, Antwerp, Belgium, 15-19 Apr 1985)				
1	*See* UCRL-92089	E 1.99:	DE85010470	MN -22	10:25286
CONF-8504109-	(SPIE technical symposium - East '85, Arlington, VA, USA, 8-12 Apr 1985)				
1	*See* SERI/TP-212-2697	E 1.99:	DE85008799	MN -63	10:25434
CONF-8504110-	(Joint Los Alamos/CEA meeting on Monte Carlo methods, Cadarache, France, 22-26 Apr 1985)				
4	*See* LA-UR-85-1175	E 1.99:	DE85010796	MN -32	10:26532
5	*See* LA-UR-85-1194	E 1.99:	DE85010791	MN -32	10:26533
6	*See* LA-UR-85-1224	E 1.99:	DE85010720	MN -34C	10:26420
7	*See* LA-UR-85-1293	E 1.99:	DE85010702	MN -34A	10:26422
8	*See* LA-UR-85-1320	E 1.99:	DE85010755	MN -20d	10:26464
9	*See* LA-UR-85-1314	E 1.99:	DE85010758	MN -20d	10:26463
10	*See* LA-UR-85-1317	E 1.99:	DE85010756	MN -34D	10:26352
11	*See* LA-UR-85-1315	E 1.99:	DE85010757	MN -21	10:26506
12	*See* LA-UR-85-1173	E 1.99:	DE85010765	MN -34C	10:26442
13	*See* LA-UR-85-1243	E 1.99:	DE85010716	MN -34C	10:26421
15	*See* LA-UR-85-1267	E 1.99:	DE85010708	MN -34C	10:26443
16	*See* LA-UR-85-1207	E 1.99:	DE85010786	MN -34C	10:26419
17	*See* LA-UR-85-1174	E 1.99:	DE85010764	MN -34C	10:26418
CONF-8504111-	(1. international symposium on precise positioning with the global positioning system, Rockville, MD, USA, 15-19 Apr 1985)				
1	*See* SLAC-PUB-3620	E 1.99:	DE85010556	MN -28	10:26004
CONF-8504115-	(3. international conference on crystalline field effects in f-electron systems: ICCF5, Sendai, Japan, 15-18 Apr 1985)				
1	*See* BNL-36359	E 1.99:	DE85010955	MN -34C	10:25796
2	*See* LA-UR-85-1223	E 1.99:	DE85010783	MN -34A	10:26438

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3	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85010512	MN -25	10:25840
CONF-8504116-	(Workshop on ion mixing and surface alloying II, Pasadena, CA, USA, 19-20 Apr 1985)			
1	*See* SAND-85-0949C	E 1.99: DE85010656	MN -25	10:25817
CONF-8504117-	(Intelligent systems and machines conference, Rochester, MI, USA, 22-24 Apr 1985)			
1	*See* LA-UR-85-1312	E 1.99: DE85010759	MN -32	10:26534
CONF-8504120-	(5. solar and biomass energy symposium, Atlanta, GA, USA, 23 Apr 1985)			
1	*See* PNL-SA-13008	E 1.99: DE85010965	MN -61D	10:25388
CONF-8504121-	(Computer graphics '85, Dallas, TX, USA, 14 Apr 1985)			
1	*See* PNL-SA-12772	E 1.99: DE85010977	MN -32	10:26536
CONF-850504-	(Particle accelerator conference, Vancouver, Canada, 13-16 May 1985)			
3	*See* SAND-84-2292C	E 1.99: DE85010670	MN -28	10:25974
4	*See* LA-UR-85-1151	E 1.99: DE85010770	MN -28	10:25982
5	*See* LA-UR-85-1403	E 1.99: DE85010744	MN -28	10:25998
6	*See* LA-UR-85-1413	E 1.99: DE85010743	MN -28	10:25987
7	*See* LA-UR-85-1489	E 1.99: DE85010728	MN -20	10:26507
8	*See* LA-UR-85-1402	E 1.99: DE85010745	MN -28	10:25973
9	*See* LA-UR-85-1193	E 1.99: DE85010792	MN -28	10:25983
11	*See* LA-UR-85-1508	E 1.99: DE85010725	MN -28	10:25999
12	*See* LA-UR-85-1205	E 1.99: DE85010787	MN -28	10:25996
13	*See* LA-UR-85-1332	E 1.99: DE85010753	MN -28	10:25985
20	*See* LA-UR-85-1328	E 1.99: DE85010754	MN -28	10:25984
21	*See* LA-UR-85-1401	E 1.99: DE85010746	MN -28	10:25986
23	*See* LA-UR-85-1227	E 1.99: DE85010719	MN -28	10:25997
24	*See* LA-UR-85-1515	E 1.99: DE85010722	MN -28	10:25989
CONF-850506-	(9. symposium on microdosimetry, Toulouse, France, 20-24 May 1985)			
2	*See* UCRL-91593	E 1.99: DE85011362	MN -48	10:26185
CONF-850507-	(International conference on nuclear data for basic and applied science, Santa Fe, NM, USA, 13-17 May 1985)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85010295	MN -20f	10:26497
2	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85010254	MN -34C	10:26369
5	*See* SAND-85-0087C	E 1.99: DE85010661	MN -25	10:25872
CONF-850511-	(Fuel cell seminar, Tucson, AZ, USA, 19-22 May 1985)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85010268	MN -93A	10:25722
CONF-850533-	(6. symposium on X- and gamma-ray sources and applications, Ann Arbor, MI, USA, 21-23 May 1985)			
3	*See* LA-UR-85-1299	E 1.99: DE85010763	MN -34C	10:26011
CONF-850565-	(13. biennial lignite symposium on technology and use of low-rank coals, Bismarck, ND, USA, 21-23 May 1985)			
1	*See* DOE/FE/60181-120	E 1.99: DE85010158	MN -90c	10:25159
2	*See* DOE/FE/60181-130	E 1.99: DE85009970	MN -90b	10:25190
CONF-850578-	(DOE/BES contractors' combustion meeting, Lake Geneva, WI, USA, 22-24 May 1985)			
2	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85010284	MN -4	10:25905
CONF-8505115-	(SPE/DOE symposium on low permeability reservoirs, Denver, CO, USA, 19-22 May 1985)			
3	*See* LA-UR-85-1139	E 1.99: DE85010778	MN -92a	10:25249
CONF-8505130-	(6. topical conference on radio frequency plasma heating, Pine Mountain, GA, USA, 13-15 May 1985)			
1	*See* GA-A-17969	E 1.99: DE85010682	MN -20	10:26460
2	*See* GA-A-17992	E 1.99: DE85011390	MN -20a	10:26461
CONF-8505131-	(Spring DECUS symposium, New Orleans, LA, USA, 27-31 May 1985)			
1	*See* SAND-85-0952C	E 1.99: DE85010652	MN -32	10:26541
CONF-8505132-	(2. workshop on solar assisted heat pumps with ground coupled storage, Vienna, Austria, 8-10 May 1985)			
1	*See* BNL-36191	E 1.99: DE85010950	MN -59A	10:25453
CONF-8505133-	(Machine workshop on 6 GeV synchrotron radiation source, Washington, DC, USA, 28-30 May 1985)			
1	*See* BNL-36302	E 1.99: DE85010959	MN -28	10:25978
CONF-850604-	(INTERSOL '85 - Solar energy--the diverse solution, Montreal, Canada, 23-29 Jun 1985)			
1	*See* LA-UR-85-728	E 1.99: DE85007685	MN -59A	10:25469
CONF-850606-	(American Society of Heating, Refrigerating and Air-Conditioning Engineers' semiannual meeting, Honolulu, HI, USA, 23-27 Jun 1985)			
3	*See* SAND-85-0449C	E 1.99: DE85011191	MN -63	10:25422
4	*See* BNL-36186	E 1.99: DE85010548	MN -95d	10:25731
CONF-850607-	(AIAA thermophysics conference, Williamsburg, VA, USA, 18-20 Jun 1985)			
2	*See* LA-UR-85-1237	E 1.99: DE85010717	MN -80	10:25581
CONF-850608-	(Spring conference on experimental mechanics, Las Vegas, NV, USA, 9-13 Jun 1985)			
2	*See* SAND-85-0138C	E 1.99: DE85010071	MN -37	10:26026

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CONF-850610-	(Annual meeting of the American Nuclear Society, Boston, MA, USA, 9-14 Jun 1985)				
3	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85006225	MN -79c	10:25575
5	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85006198	MN -34C	10:26363
9-Summ.	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85006124	MN -20	10:26498
10-Summ.	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85006215	MN -2	10:25613
11-Summ.	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85006216	MN -20b	10:26499
13	*See* BNL-NCS-35794	E 1.99:	DE85005953	MN -34C	10:26362
14	*See* LA-UR-85-400	E 1.99:	DE85006681	MN -34C	10:26417
19	*See* BNL-NUREG-36035		TI85007924	MN -78	10:25607
20	*See* BNL-NUREG-35926		TI85007926	MN -78	10:25605
27	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010296	MN -78	10:25614
CONF-850612-	(Air Pollution Control Association annual meeting and exhibition, Detroit, MI, USA, 16-21 Jun 1985)				
1	*See* UCRL-92329	E 1.99:	DE85008964	MN -11	10:26203
3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85010508	MN -90i	10:26062
CONF-850614-	(ASME-ASCE fluids engineering conference and joint mechanics conference, Albuquerque, NM, USA, 24-26 Jun 1985)				
2	*See* SAND-84-1544C	E 1.99:	DE85002626	MN -92a	10:25242
3	*See* SAND-85-0662C	E 1.99:	DE85009504	MN -38	10:25965
5	*See* UCRL-92355	E 1.99:	DE85010102	MN -11	10:26243
CONF-850622-	(American Control conference, Boston, MA, USA, 19-21 Jun 1985)				
1	*See* UCRL-91619	E 1.99:	DE85000748	MN -38	10:25911
2	*See* UCRL-91623	E 1.99:	DE85001566	MN -32	10:26544
2-Rev.1	*See* UCRL-91623-Rev.1	E 1.99:	DE85010040	MN -32	10:26545
CONF-850641-	(5. conference on the computation of electromagnetic fields, Ft. Collins, CO, USA, 3-6 Jun 1985)				
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85002742	MN -28	10:25979
CONF-850646-	(2. international specialists meeting on small break LOCA analyses in LWRs, Pisa, Italy, 24-26 Jun 1985)				
1	*See* BNL-NUREG-36009		TI85007483	MN -78	10:25606
CONF-850655-	(16. world gas conference, Munich, F.R. Germany, 24-27 Jun 1985)				
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85005069	MN -61A	10:25382
CONF-850656-	(16. IEEE annual PESC conference, Toulouse, France, 24-28 Jun 1985)				
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85006197	MN -38	10:25949
CONF-850669-	(North American radio science meeting, Vancouver, Canada, 17-21 Jun 1985)				
1	*See* UCRL-91888	E 1.99:	DE85006639	MN -38	10:25955
CONF-850670-	(ASME pressure vessel and piping division conference, New Orleans, LA, USA, 24-29 Jun 1985)				
3	*See* HEDL-SA-3155FP	E 1.99:	DE85007460	MN -25	10:25809
13	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010249	MN -79	10:25615
14	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85010499	MN -79	10:25616
15	*See* SAND-84-1899C	E 1.99:	DE85010653	MN -71	10:25922
CONF-850671-	(26. U.S. symposium on rock mechanics, Rapid City, SD, USA, 26-28 Jun 1985)				
1	*See* SAND-84-2145C	E 1.99:	DE85006975	MN -70	10:26239
2	*See* SAND-84-2126C	E 1.99:	DE85007003	MN -70	10:25312
4	*See* UCRL-91639	E 1.99:	DE85007975	MN -35	10:26048
7	*See* SAND-84-2021C	E 1.99:	DE85008068	MN -70	10:26238
8	*See* SAND-85-0444C	E 1.99:	DE85007883	MN -35	10:25862
10	*See* UCRL-91468	E 1.99:	DE85008297	MN -85	10:26241
11	*See* SAND-84-2135C	E 1.99:	DE85008402	MN -91	10:25260
12	*See* SAND-84-1808C	E 1.99:	DE85008408	MN -70	10:26236
13	*See* SAND-84-2020C	E 1.99:	DE85008421	MN -70	10:26237
14	*See* UCRL-92316	E 1.99:	DE85008963	MN -11	10:26242
15	*See* SAND-84-2137C	E 1.99:	DE85009439	MN -92a	10:25243
16	*See* LBL-19180	E 1.99:	DE85009935	MN -38	10:26232
CONF-850679-	(18. American Society for Testing and Materials symposium, Boulder, CO, USA, 1 Jun 1985)				
1	*See* SAND-84-2058C	E 1.99:	DE85006992	MN -25	10:25816
CONF-850685-	(3. international conference on solid-state sensors and actuators, Philadelphia, PA, USA, 12-15 Jun 1985)				
2	*See* SAND-84-2436C	E 1.99:	DE85009125	MN -37	10:26025
CONF-8506104-	(26. Society of Professional Well Log Analysts annual logging symposium, Dallas, TX, USA, 17-20 Jun 1985)				
2	*See* LA-UR-84-1140	E 1.99:	DE85010777	MN -92a	10:25248
CONF-8506105-	(International symposium on circuits and systems, Kyoto, Japan, 5-7 Jun 1985)				
1	*See* UCRL-92312	E 1.99:	DE85008965	MN -32	10:26546
CONF-8506106-	(Robots 9 conference, Detroit, MI, USA, 2-6 Jun 1985)				
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85008652	MN -38	10:25914
CONF-8506111-	(Conference on structural integrity and durability of reusable space propulsion systems, Cleveland, OH, USA, 4-5 Jun 1985)				
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010509	MN -25	10:25802

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CONF-8506113-	(Symposium on condenser biofouling control, Lake Buena Vista, FL, USA, 18-20 Jun 1985)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85010257	MN -37	10:26022
CONF-850706-	(8. international symposium on detonation, Albuquerque, NM, USA, 15-19 Jul 1985)			
17	*See* LA-UR-85-1201	E 1.99: DE85010790	MN -45	10:26031
CONF-850801-	(International symposium on geothermal energy, Kailua Kona, HI, USA, 26-30 Aug 1985)			
28	*See* SAND-85-0849C	E 1.99: DE85010124	MN -66	10:25496
30	*See* SAND-85-0783C	E 1.99: DE85009836	MN -66	10:25495
CONF-850804-	(World congress on heating, ventilating and air conditioning--international exhibition, Copenhagen, Denmark, 25-30 Aug 1985)			
1	*See* BNL-36151	E 1.99: DE85009762	MN -41	10:25730
CONF-850861-	(11. International Association of Mathematics and Computers Simulation world congress, Oslo, Norway, 5-9 Aug 1985)			
1-Rev.1	*See* UCRL-91824-Rev.1	E 1.99: DE85010929	MN -32	10:26324
CONF-851007-	(3. international meeting on reactor thermal hydraulics, Newport, RI, USA, 15-18 Oct 1985)			
5	*See* LA-UR-85-915	E 1.99: DE85009552	MN -79p	10:25626
COO-				
2218-316	*See* CONF-850411-11	E 1.99: DE85010687	MN -20	10:26496
2985-7	*See* DOE/ET/34203-T11	E 1.99: DE85004674	MN -78	10:25535
2985-8	*See* DOE/ET/34203-T8	E 1.99: DE85004675	MN -78	10:25534
2985-10	*See* DOE/ET/34203-T6	E 1.99: DE85004671	MN -78	10:25533
4014-9	*See* DOE/ET/34205-T1	E 1.99: DE85004666	MN -77	10:25536
CTH-JVG-				
11	NTIS (US Sales Only), PC A04/MF A01; 1	DE85750872	MN -94e	10:25658
12	NTIS (US Sales Only), PC A04/MF A01; 1	DE85750871	MN -94e	10:25733
13	NTIS (US Sales Only), PC A04/MF A01; 1	DE85750890	MN -95d	10:25734
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82-79	*See* EHD-82-79	DE85700602	MN -41	10:26430
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0015/ 4	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99: DE85011692	MN -95f	10:25713
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29	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85009031	MN -79h	10:25617
31	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85009014	MN -79	10:25577
34	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE85009032	MN -79h	10:25618
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T110	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE85009820	MN -62a	10:25448
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0252	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99: DE85010664	MN -92a	10:25238
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1	NTIS, PC A08/MF A01; 1 (GPO Dep.)	E 1.99: DE85011451	MN -98	10:25701
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0202(85/ 2Q)	NTIS, PC A03/MF A01; 1 - GPO (GPO Dep.)	E 1.99: DE85011693	MN -98	10:25233
0226(85/ 01)	NTIS, PC A03/MF A01 - GPO (GPO Dep.)	E 1.99: DE85010007	MN -98E	10:25702
0376(82)	NTIS, PC A22/MF A01; 1 - GPO (GPO Dep.)	E 1.99: DE85010678	MN -98	10:25714
0380(85/ 02)	NTIS, PC A08/MF A01; 1 - GPO (GPO Dep.)	E 1.99: DE85011278	MN -98B	10:25234
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T2	NTIS, PC A09/MF A01; 1 (GPO Dep.)	E 1.99: DE85010814	MN -38	10:25916

Report Number	Availability Source	File Number	Distribution Category	Abstract Number
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DOE/ER/10275-1A	NTIS, PC A03/MF A01; 1	DE83004080	MN -2	10:26101
DOE/ER/10425-13	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85010685	MN -4	10:25876
DOE/ER/10428-05	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85007345	MN -25	10:25803
DOE/ER/10662-T2	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85010611	MN -4	10:25888
DOE/ER/10748-5	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85009750	MN -34A	10:26307
DOE/ER/10749-T1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85011154	MN -20	10:26459
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DOE/ER/45031-1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85010922	MN -4	10:25852
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DOE/ID/12488-T1-Vol.1-Rev.0	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99: DE85011076	MN -78	10:25655
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DOE/JPL/956334-1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE85011272	STD -63b	10:25417
DOE/JPL/957031-85/ 2	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE85011142	STD -63b	10:25418
DOE/MA-0087	NTIS, PC A06/MF A01; 1; (GPO Dep.)	E 1.99: DE85010699	STD -13	10:26521
DOE/MC/11955-1752	NTIS, PC A09/MF A01 (GPO Dep.)	E 1.99: DE85003370	STD -90c	10:25097
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DOE/MC/16512-1619	NTIS, PC A07/MF A01; 1 (GPO Dep.)	E 1.99: DE84009253	STD -90h	10:25098

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DOE/MC/19210-1819	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99: DE85011791	STD -90a	10:25101
DOE/MC/19314-6	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85010177	MN -90g	10:25102
DOE/MC/19326-1699	NTIS, PC A12/MF A01; 1 (GPO Dep.)	E 1.99: DE85001991	STD -90e	10:25205
DOE/MC/20212-1739	NTIS, PC A05/MF A01 (GPO Dep.)	E 1.99: DE85008310	STD -93A	10:25724
DOE/MC/20400-1751	NTIS, PC A15/MF A01; 1 (GPO Dep.)	E 1.99: DE85003369	STD -93	10:25726
DOE/MC/21225-8	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE85008979	MN -90b	10:25103
DOE/METC-85/ 10	NTIS, PC A11/MF A01 (GPO Dep.)	E 1.99: DE85001975	STD -93A	10:25727
85/ 2002	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE85001977	STD -90h	10:25104
85/ 2003	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99: DE85001998	STD -90c	10:25105
DOE/METC/SP-215	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE85001984	STD -92a	10:25246
218	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE85001986	STD -92a	10:25247
DOE/MI/10024-T1	NTIS, PC A05; 3 (GPO Dep.)	E 1.99: DE85006908	STD -90e	10:25206
DOE/NASA-0006-2	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99: DE85009910	MN -96	10:25804
DOE/NBM-5011054	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99: DE85011054	MN -95	10:25685
5011577	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE85011577	MN -13	10:25718
DOE/NE/37900-6	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99: DE85010676	MN -80	10:25805
DOE/NV/10322-1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99: DE85010690	MN -11	10:26220
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27-Vol.2	NTIS, PC A18/MF A01; 1 (GPO Dep.)	E 1.99: DE85009916	STD -70A	10:25325
DOE/OR/21400-T113	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99: DE85010821	MN -90i	10:26096
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DOE/PC/20080-T1	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE85010197	MN -90a	10:25877
DOE/PC/30027-60	NTIS, PC A08/MF A01; 1 (GPO Dep.)	E 1.99: DE85011960	MN -90d	10:25106
61	NTIS, PC A07/MF A01 (GPO Dep.)	E 1.99: DE85011961	STD -90d	10:25107
DOE/PC/40077-T8	NTIS, PC A12/MF A01; 1 (GPO Dep.)	E 1.99: DE85009613	STD -90d	10:25383
DOE/PC/40785-12	NTIS, PC A06/MF A01 (GPO Dep.)	E 1.99: DE85010393	STD -90d	10:25108
DOE/PC/50030-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85006532	MN -90d	10:25109
T2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85006530	MN -90d	10:25110
T3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85006531	MN -90d	10:25111
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DOE/PC/50270-T2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85004141	MN -90b	10:25207
T3	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85004142	MN -90b	10:25208
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DOE/PC/50797-T10	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85010437	MN -90a	10:25146
DOE/PC/50800-T10	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85010554	MN -90a	10:25117
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DOE/PC/60045-T6	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85010432	STD -90d	10:25191
DOE/PC/60778-6	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85011299	MN -90d	10:25118
DOE/PC/60779-6	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85010143	MN -90a	10:25878
DOE/PC/60783-T1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85010427	STD -90d	10:25119

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DOE/PC/60800-5	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85009863	MN -90c	10:25122
DOE/PC/60804-T6	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85009297	MN -90d	10:25148
DOE/PC/60805-T6	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE85009969	MN -90a	10:25384
DOE/PC/60811-6	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE85011696	STD -90d	10:25149
DOE/PC/70725-2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85010602	MN -90b	10:25192
DOE/PC/70770-3	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE85009350	STD -90e	10:25211
DOE/PC/70780-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85010074	MN -90a	10:25392
DOE/PC/70792-T2	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85010435	MN -90a	10:25150
DOE/PC/70793-T2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85009528	MN -90a	10:25151
DOE/PC/70794-2	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE85010024	STD -90e	10:25212
DOE/PC/70801-T2	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85009298	MN -90a	10:25123
DOE/PC/70806-T1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85010428	MN -90d	10:25124
DOE/PC/70809-T1	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE85009911	STD -90	10:25152
DOE/PC/70814-2	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85009123	MN -90d	10:25125
DOE/PC/70815-T3	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE85011511	MN -90e	10:25213
DOE/PC/71257-T1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85011538	MN -90d	10:25126
DOE/PC/72007-T3	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE85011186	STD -90b	10:25193
DOE/PC/72008-T2	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE85009912	STD -90b	10:25194
DOE/PC/73226-T1	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE85009834	STD -90i	10:25160
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DOE/R0/00498-T1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85010589	MN -59A	10:25407
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DOE/R3/02404-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85009177	MN -62a	10:25483
DOE/R3/02405-T1	NTIS, PC A02; 3	DE85009179	MN -59B	10:25459
DOE/R3/02407-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85009180	MN -60	10:25502
DOE/R3/02410-T1	NTIS, PC A04; 3	DE85008995	MN -59B	10:25738
DOE/R3/02415-T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE85009184	MN -59B	10:25460
DOE/R3/02422-T1	NTIS, PC A03; 3	DE85009186	MN -59A	10:25461
DOE/R3/02423-T1	NTIS, PC A02; 3	DE85009514	MN -59B	10:25462
DOE/R3/02428-T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE85009268	MN -60	10:25503
DOE/R3/02431-T1	NTIS, PC A02; 3	DE85008985	MN -96	10:25508
DOE/R3/02438-T1	NTIS MF A01; 2 (GPO Dep.)	E 1.99: DE85009244	MN -60	10:25504
DOE/R3/02439-T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE85008996	MN -59B	10:25463
DOE/R3/06097-T1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99: DE85009168	MN -59B	10:25739
DOE/R3/06099-T1	NTIS, PC A02; 3	DE85008252	MN -59B	10:25464
DOE/R3/06118-T1	NTIS MF A01; 2 (GPO Dep.)	E 1.99: DE85010169	MN -59B	10:25465
DOE/R3/08094-T1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99: DE85010170	MN -58	10:25466
DOE/R3/08100-T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE85010172	MN -59B	10:25467
DOE/R8/01086-T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE85011346	MN -95d	10:25780

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DOE/R8/01413-T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85011317	MN -95e	10:25781
DOE/RA/50183-T1	NTIS, PC A13/MF A01; 1 (GPO Dep.)	E 1.99:	DE85010194	MN -05	10:25695
DOE/RA/50231-T3	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85011267	MN -90	10:25509
DOE/RG/10219-T1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85009405	MN -98E	10:25696
DOE/RG/10312-1-Vol.1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010948	STD -90i	10:25168
1-Vol.2	NTIS, PC A08/MF A01 (GPO Dep.)	E 1.99:	DE85010939	STD -90i	10:25169
DOE/RG/10399-T1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85009351	MN -98E	10:25697
DOE/RG/10494-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85011149	MN -92	10:25223
DOE/RW-0024	NTIS, PC A10/MF A01; 1 (GPO Dep.)	E 1.99:	DE85011220	MN -70	10:25298
DOE/SF/00098-T5	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010181	MN -11	10:25170
DOE/SR/10995-1	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85009867	MN -41	10:26219
DP-226	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85008061	MN -46	10:25917
DP-MS-84-81	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010064	MN -38	10:25806
84-130	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010224	MN -4	10:25901
85-26	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010223	MN -48	10:25902
EGG-2352	*See* NUREG/CR-4033		TI85011276	MN -41	10:26183
2355	*See* NUREG/CR-4181		TI85010918	MN -78	10:25302
2367	*See* NUREG/CR-4084		TI85010464	MN -78	10:25291
EGG/10282-1057	NTIS, PC A19/MF A01; 1 (GPO Dep.)	E 1.99:	DE85010212	MN -2	10:26023
EGG-M-20884	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85008439	MN -20d	10:26504
24384	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85006378	MN -78	10:25621
EGG-MS-6708	*See* NUREG/CR-4212		TI85010862	MN -78	10:25570
EGG-PBS-6818	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE85010132	MN -97e	10:25493
6844	NTIS, PC A02/MF A01 - GPO		TI85011255	MN -70	10:25299
EGG-SEMI-6827	NTIS, PC A05/MF A01 - GPO		TI85011257	MN -78	10:25622
EGG-TMI-6685	NTIS, PC A11/MF A01 (GPO Dep.)	E 1.99:	DE85010919	MN -78	10:25546
EHD-82-79	NTIS (US Sales Only), PC A05/MF A01		DE85700602	MN -41	10:26430
EPA-600/ D-84/ 294	*See* PB-85-150852/XAB				10:26078
EPA/520/5-84/ 029	*See* PB-85-164838/XAB				10:26124
EPRI-AP-3922-Vol.1	NTIS (US Sales Only), PC A10/MF A01; 1 - Research Reports Center, Box 50490, Palo Alto, CA 94303 (GPO Dep.)	E 1.99:	DE85011443	MN -90d	10:25127
3922-Vol.2	NTIS (US Sales Only), PC A08/MF A01; 1 - Research Reports Center, Box 50490, Palo Alto, CA 94303 (GPO Dep.)	E 1.99:	DE85011444	MN -90d	10:25128
3982	Research Reports Center, Box 50490, Palo Alto, CA 94303		TI8.920609	ND -62a	10:25451
EPRI-CS-3901-Vol.2	Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303		TI85920596	ND -90i	10:25171
3921	Research Reports Center, Box 50490, Palo Alto, CA 94303		TI85920589	ND -90i	10:25161
3969	Research Reports Center, Box 50490, Palo Alto, CA 94303		TI85920611	ND -90	10:25510
3976	Research Reports Center, Box 50490, Palo Alto, CA 94303		TI85920623	ND -11	10:25516
EPRI-EA-1901-1	NTIS, PC A03/MF A01; 1 - Research Reports Center, Box 50490, Palo Alto, CA 94303 (GPO Dep.)	E 1.99:	DE85005925	MN -11	10:25517
3995	Research Reports Center, Box 50490, Palo Alto, CA 94303		TI85920630	ND -95d	10:25682
EPRI-EM-3919-CCM	Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303		TI85920614	ND -95d	10:25759
4013	Research Reports Center, Box 50490, Palo Alto, CA 94303		TI85920583	ND -59B	10:25468
EPRI-NP-3605-CCM-Vol.1	Research Reports Center, Box 50490, Palo Alto, CA 94303, $10.00		TI85920586	ND -80	10:25623
3684-SR-Vol.1	Research Reports Center, Box 50490, Palo Alto, CA 94303, $22.00		TI85920101	ND -78	10:25537

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3831	Research Reports Center, Box 50490, Palo Alto, CA 94303		TI85920594	ND -78	10:25538
3924-SR	Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303, $44.50		TI85920567	ND -78	10:25564
3927	Research Reports Center, P.O. Box 50490, Palo alto, CA 94303		TI85920584	ND -78	10:25592
3928	Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303		TI85920595	ND -80	10:25565
3941	Research Reports Center, Box 50490, Palo Alto, CA 94303		TI85920565	ND -80	10:25624
3944	Research Reports Center, Box 50490, Palo Alto, CA 94303		TI85920580	ND -78	10:25566
3946	Research Reports Center, Box 50490, Palo Alto, CA 94303		TI85920593	ND -78	10:25539
3947	Research Reports Center, Box 50490, Palo Alto, CA 94303		TI85920606	ND -78	10:25567
3949M	Research Reports Center, Box 50490, Palo Alto, CA 94303		TI85920590	ND -78	10:25807
3957M	Research Reports Center, Box 50490, Palo Alto, CA 94303, $8.50		TI85920561	ND -78	10:25808
3966-CCM-Vol.5	Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303		TI85920610	ND -78	10:25568
3970M	Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303		TI85920560	ND -78	10:25540
ERP/MSL-					
81-57	NTIS (US Sales Only), PC A02/MF A01		DE85700587	MN -86	10:25283
83-94(TR)	NTIS (US Sales Only), PC A25/MF A01; 1		DE84901497	MN -94c	10:25665
ESG-DOE-					
13413	NTIS, PC A16/MF A01; 1 (GPO Dep.)	E 1.99:	DE85009136	STD -80	10:25580
EUR-					
7814-EN	Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities			ND -92b	10:25385
8299-DE	*See* EUR-8299/XAB				10:25488
8299/ XAB	NTIS PC E05/MF E01				10:25488
8669-EN	*See* PB-85-159002/XAB				10:25303
9005-EN	*See* PB-85-157519/XAB				10:25519
9074-EN-IT	*See* PB-85-157485/XAB				10:25791
9111-EN	*See* PB-85-159028/XAB				10:25376
9112-EN	Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities			ND -61G	10:25372
9114-EN	Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities			ND -61B	10:25419
9128-EN	*See* PB-85-159036/XAB				10:26084
9275-EN	Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities			ND -61G	10:25373
9280-EN	Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities			ND -90i	10:25129
9310-EN	Commission of the European Communities, Luxembourg			ND -38	10:25961
9322-EN	Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities			ND -48	10:26151
9333-DE	*See* EUR-9333/XAB				10:25489
9333/ XAB	NTIS PC E06/MF E01				10:25489
9443-EN	Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities			ND -98F	10:25675
FE-					
2315-112	*See* DOE/ET/10532-T22	E 1.99:	DE85008978	STD -90d	10:25094
2469-94	*See* DOE/ET/10283-T20	E 1.99:	DE85010818	MN -90	10:25093
FFA-TN-					
1983-44	*See* STEV-VIND-84-1		DE85750887	MN -60	10:25500
FNAL/C-					
85/ 36	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85010141	MN -34D	10:26327
FNAL/Pub-					
84/ 131-A	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85009538	MN -34A	10:26258
FNAL-TM-					
1302	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE85011722	STD -28	10:25980
FOA-C-					
40203-B4	*See* PB-85-163798/XAB				10:25241
GA-A-					
17881	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010445	MN -20	10:26505
17969	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010682	MN -20	10:26460
17992	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85011390	MN -20a	10:26461
GAO/RCED-					
85-54	General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877		TI85901368	MN -11	10:25698
GEND-					
049	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE85010614	STD -78	10:25625

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GKSS-					
84/ E/ 54	NTIS (US Sales Only), PC A03/MF A01		DE85751613	MN -11	10:26072
GSF-BPT-					
10/ 84	NTIS (US Sales Only), PC A05/MF A01; 1		DE85751615	MN -11	10:26054
HEDL-SA-					
3155FP	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85007460	MN -25	10:25809
HEDL-TME-					
84-31-Vol.3	*See* NUREG/CR-3746-Vol.3		TI85010597	MN -78	10:25541
HSE-Trans-					
8335	NTIS (US Sales Only), PC A03; 3		DE85900942	MN -90i	10:25188
IAEA-TECDOC-					
315	NTIS (US Sales Only), PC A15/MF A01		DE85780873	MN -51	10:25279
IC-					
84/ 19	NTIS (US Sales Only), PC A02/MF A01		DE85700576	MN -34C	10:26374
84/ 31	NTIS (US Sales Only), PC A02/MF A01		DE85700583	MN -4	10:25857
84/ 34	NTIS (US Sales Only), PC A03/MF A01		DE85700549	MN -34C	10:26371
84/ 35	NTIS (US Sales Only), PC A02/MF A01		DE85700592	MN -51	10:26088
84/ 41	NTIS (US Sales Only), PC A02/MF A01		DE85700550	MN -34C	10:26387
84/ 45	NTIS (US Sales Only), PC A02/MF A01		DE85700551	MN -34C	10:26398
84/ 56	NTIS (US Sales Only), PC A02/MF A01		DE85700584	MN -4	10:25858
84/ 61	NTIS (US Sales Only), PC A02/MF A01		DE85700589	MN -25	10:25810
84/ 81	NTIS (US Sales Only), PC A02/MF A01		DE85700590	MN -25	10:25811
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347	NTIS (US Sales Only), PC A02/MF A01		DE85700578	MN -34C	10:26388
352	NTIS (US Sales Only), PC A04/MF A01		DE85700577	MN -34C	10:26375
354	NTIS (US Sales Only), PC A02/MF A01		DE85700572	MN -34C	10:26383
382	NTIS (US Sales Only), PC A02/MF A01		DE85700552	MN -34C	10:26400
383	NTIS (US Sales Only), PC A02/MF A01		DE85700612	MN -32	10:26531
392	NTIS (US Sales Only), PC A03/MF A01		DE85700557	MN -34C	10:26376
394	NTIS (US Sales Only), PC A02/MF A01		DE85700558	MN -34C	10:26401
398	NTIS (US Sales Only), PC A02/MF A01		DE85700553	MN -34C	10:26402
400	NTIS (US Sales Only), PC A02/MF A01		DE85700559	MN -34C	10:26403
401	NTIS (US Sales Only), PC A02/MF A01		DE85700560	MN -34C	10:26404
403	NTIS (US Sales Only), PC A02/MF A01		DE85700561	MN -34C	10:26386
406	NTIS (US Sales Only), PC A02/MF A01		DE85700554	MN -34C	10:26405
408	NTIS (US Sales Only), PC A02/MF A01		DE85700562	MN -34C	10:26406
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423	NTIS (US Sales Only), PC A03/MF A01		DE85700573	MN -34C	10:26390
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435	NTIS (US Sales Only), PC A02/MF A01		DE85700568	MN -34C	10:26372
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443	NTIS (US Sales Only), PC A03/MF A01		DE85700571	MN -34C	10:26411
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84-01	NTIS (US Sales Only), PC A03/MF A01		DE85700593	MN -11	10:26083
IIES-dp-					
83-11	Wissenschaftszentrum Berlin (Germany, F.R.). Internationales Inst. fuer Umwelt und Gesellschaft			ND -98E	10:25715
IMMR-					
83-082	*See* PB-85-159846/XAB				10:25133
83-083	*See* PB-85-166015/XAB				10:25180
83-086	*See* PB-85-156339/XAB				10:25178
83-087	*See* PB-85-159820/XAB				10:25179
INDC(JPN)-					
99/ L	*See* NEANDC(J)-113/U		DE85901374	MN -34C	10:26365
INFO-					
0084	NTIS (US Sales Only), PC A05/MF A01		DE85700607	MN -80	10:25595
0087	NTIS (US Sales Only), PC A09/MF A01		DE85700603	MN -41	10:26431
0088	NTIS (US Sales Only), PC A05/MF A01		DE85700598	MN -41	10:25597
0090	NTIS (US Sales Only), PC A02/MF A01		DE85700597	MN -48	10:26432
0091	NTIS (US Sales Only), PC A02/MF A01		DE85700601	MN -41	10:26433
INIS-mf-					
9483	NTIS (US Sales Only), PC A03/MF A01		DE85700614	MN -2	10:26309
9522	NTIS (US Sales Only), PC A03/MF A01		DE85700615	MN -2	10:25529
IPEN-Inf-					
12	NTIS (US Sales Only), PC A04/MF A01		DE85700585	MN -4	10:25859
IPEN-Pub-					
54	NTIS (US Sales Only), PC A02/MF A01		DE85700586	MN -4	10:25903
56	NTIS (US Sales Only), PC A02/MF A01		DE85700579	MN -4	10:25870
57	NTIS (US Sales Only), PC A02/MF A01		DE85700580	MN -4	10:25871
IPNO-DRE-					
83-37	NTIS (US Sales Only), PC A02/MF A01		DE85750913	MN -34C	10:26367
84-11	NTIS (US Sales Only), PC A02/MF A01		DE85750910	MN -34C	10:26368
IS-					
4874	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99:	DE85011292	MN -90	10:25768
IS-T-					
1168	NTIS, PC A14/MF A01 (GPO Dep.)	E 1.99:	DE85011359	MN -90a	10:25890

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JAPFNR-					
779	NTIS (US Sales Only), PC A07/MF A01; 1		DE85900473	STD -79d	10:25591
JINR-R-					
9-83-90	NTIS (US Sales Only), PC A02/MF A01		DE85700605	MN -28	10:25981
Juel-Spez-					
274	NTIS (US Sales Only), PC A14/MF A01; 1		DE85751612	MN -11	10:26097
K/PS-					
5056	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85011252	MN -22	10:25285
KFK-					
3527	NTIS (US Sales Only), PC A04/MF A01		DE85751614	MN -90i	10:26073
KHM-TR-					
57	NTIS (US Sales Only), PC A17/MF A01; 1		DE85750873	MN -90i	10:25162
74	NTIS (US Sales Only), PC A04/MF A01; 1		DE85750874	MN -90i	10:26074
88	NTIS (US Sales Only), PC A03/MF A01		DE85750875	MN -90i	10:25221
89	NTIS (US Sales Only), PC A03/MF A01; 1		DE85750879	MN -90i	10:25163
92	NTIS (US Sales Only), PC A10/MF A01; 1		DE85750876	MN -90i	10:25164
96	NTIS (US Sales Only), PC A07/MF A01; 1		DE85750877	MN -90i	10:26196
102	NTIS (US Sales Only), PC A04/MF A01; 1		DE85750878	MN -90i	10:25812
KMSF-U-					
1567	*See* DOE/DP/40152-T7	E 1.99:	DE85008157	MN -21	10:26458
LA-					
10154-PR	NTIS, PC A07/MF A01; 1 (GPO Dep.)	E 1.99:	DE85010319	STD -70	10:25300
10227-C-Vol.1	NTIS, PC A15/MF A01; 1 (GPO Dep.)	E 1.99:	DE85007396	STD -34	10:26416
10227-C-Vol.2	NTIS, PC A15/MF A01; 1 (GPO Dep.)	E 1.99:	DE85007395	STD -34	10:26310
10238-T	NTIS, PC A08/MF A01; 1 (GPO Dep.)	E 1.99:	DE85011884	STD -38	10:25950
10301-C	NTIS, PC A16/MF A01; 1 (GPO Dep.)	E 1.99:	DE85010573	STD -11	10:26075
10310	NTIS, PC A05/MF A01 (GPO Dep.)	E 1.99:	DE85010542	MN -13	10:26520
10311-MS	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85011898	STD -34B	10:26456
10317-MS	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85010326	STD -79b	10:25578
10344-SR	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85010568	STD -59B	10:25484
LA-UR-					
84-1140	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010777	MN -92a	10:25248
85-400	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85006681	MN -34C	10:26417
85-728	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85007685	MN -59A	10:25469
85-733	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85009586	MN -37	10:26024
85-868	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85009545	MN -59B	10:25470
85-869	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85009546	MN -59B	10:25471
85-915	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85009552	MN -79p	10:25626
85-963	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85009632	MN -41	10:26057
85-1045	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85009623	MN -59B	10:25472
85-1055	NTIS, PC A02/MF A01		DE85009626	MN -32	10:26453
85-1078	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85009597	MN -34	10:26323
85-1119	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85009605	MN -21	10:26462
85-1139	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010778	MN -92a	10:25249
85-1151	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010770	MN -28	10:25982
85-1173	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010765	MN -34C	10:26442
85-1174	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85010764	MN -34C	10:26418
85-1175	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85010796	MN -32	10:26532
85-1193	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010792	MN -28	10:25983
85-1194	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010791	MN -32	10:26533
85-1201	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010790	MN -45	10:26031
85-1205	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010787	MN -28	10:25996
85-1207	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85010786	MN -34C	10:26419
85-1216	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85010784	MN -37	10:25937
85-1223	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010783	MN -34A	10:26438
85-1224	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010720	MN -34C	10:26420
85-1227	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010719	MN -28	10:25997
85-1237	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010717	MN -80	10:25581
85-1243	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85010716	MN -34C	10:26421
85-1267	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010708	MN -34C	10:26443
85-1288	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010703	MN -38	10:25938
85-1293	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010702	MN -34A	10:26422
85-1299	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010763	MN -34C	10:26011
85-1303	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010761	MN -34B	10:26293
85-1305	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85010760	MN -34B	10:26294
85-1312	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85010759	MN -32	10:26534
85-1314	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85010758	MN -20d	10:26463
85-1315	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010757	MN -21	10:26506
85-1317	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010756	MN -34D	10:26352
85-1320	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85010755	MN -20d	10:26464
85-1328	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010754	MN -28	10:25984
85-1332	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010753	MN -28	10:25985
85-1341	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85010803	MN -79p	10:25627
85-1368	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85010798	MN -79p	10:25628
85-1374	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85010782	MN -79p	10:25629
85-1401	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010746	MN -28	10:25986
85-1402	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010745	MN -28	10:25973
85-1403	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010744	MN -28	10:25998
85-1413	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010743	MN -28	10:25987
85-1439	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010739	MN -34C	10:26412
85-1452	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010737	MN -25	10:26311
85-1460	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010736	MN -34	10:25988
85-1466	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010734	MN -88	10:25177
85-1467	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010733	MN -34	10:26454

Report Number	Availability Source	File Number		Distribution Category	Abstract Number
85-1471	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85010732	MN -10	10:25813
85-1489	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010728	MN -20	10:26507
85-1508	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010725	MN -28	10:25999
85-1515	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010722	MN -28	10:25989
85-1516	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010721	MN -37	10:26020
LALP-					
84-54	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010352	MN -98E	10:25711
LBL-					
91-Rev.1-85	NTIS PC E03/MF A01 (GPO Dep.)	E 1.99:	DE85011513	STD -34D	10:26364
14996	NTIS, PC A17/MF A01; 1 (GPO Dep.)	E 1.99:	DE85010645	MN -70	10:25879
17632	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85010988	MN -25	10:25814
18146	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE85010627	STD -66b	10:25490
18335	NTIS, PC A11/MF A01; 1 (GPO Dep.)	E 1.99:	DE85008452	MN -94c	10:25896
18552	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE85010639	STD -70	10:26226
18586	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85009902	MN -59B	10:25860
18704	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010979	MN -25	10:25918
18987	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99:	DE85010982	MN -28	10:26535
19004	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010633	STD -38	10:25919
19013	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85009942	MN -37	10:25920
19033	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85011204	MN -28	10:26000
19166	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85009930	MN -11	10:26076
19180	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85009935	MN -38	10:26232
19215	NTIS, PC A18/MF A01 (GPO Dep.)	E 1.99:	DE85010980	MN -34A	10:26312
19362	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85011167	MN -25	10:25861
19398	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85011160	MN -90	10:25518
LUTKDH/TKKA-					
5009-1-12-(1983)	NTIS (US Sales Only), PC A03/MF A01; 1		DE85750880	MN -61E	10:25393
MHSMP-					
85-17	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE85010824	STD -11	10:26103
MLM-					
3236(OP)	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010809	MN -45	10:26032
3237(OP)	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010808	MN -71	10:25921
3239(OP)	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85010806	MN -35	10:26033
3240(OP)	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010805	MN -35	10:26034
3241(OP)	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85010804	MN -45	10:26035
MRC-R-					
806	*See* AD-A-149844/3/XAB				10:26043
MRL-R-					
933	*See* AD-A-149779/1/XAB				10:25933
MRP/MRL-					
82-65	NTIS (US Sales Only), PC A02/MF A01		DE85700608	MN -37	10:26012
82-77	NTIS (US Sales Only), PC A02/MF A01		DE85700591	MN -25	10:25850
82-79	NTIS (US Sales Only), PC A02/MF A01		DE85700609	MN -37	10:26013
MRP/MSL-					
82-86	NTIS (US Sales Only), PC A08/MF A01		DE85700588	MN -86	10:25284
N-					
85-12318	NTIS, PC A02/MF A01				10:25783
85-14777	NTIS, PC A03/MF A01				10:26259
85-15587	NTIS, PC A16/MF A01				10:26260
85-15588	NTIS, PC A16/MF A01				10:26261
85-15589	NTIS, PC A16/MF A01				10:26262
85-15591	NTIS, PC A16/MF A01				10:26263
85-15592	NTIS, PC A16/MF A01				10:26264
85-15595	NTIS, PC A16/MF A01				10:26265
85-15596	NTIS, PC A02/MF A01				10:26266
85-15599	NTIS, PC A10/MF A01				10:26267
85-15600	NTIS, PC A10/MF A01				10:26268
85-15607	NTIS, PC A10/MF A01				10:26269
85-15615	NTIS, PC A10/MF A01				10:26270
85-15631	NTIS, PC A10/MF A01				10:26271
85-15632	NTIS, PC A10/MF A01				10:26272
85-15633	NTIS, PC A10/MF A01				10:26273
85-15634	NTIS, PC A10/MF A01				10:26274
85-15635	NTIS, PC A10/MF A01				10:26275
85-15636	NTIS, PC A10/MF A01				10:26276
85-15637	NTIS, PC A10/MF A01				10:26277
85-15643	NTIS, PC A10/MF A01				10:26278
85-15647	NTIS, PC A10/MF A01				10:26279
85-15652	NTIS, PC A03/MF A01				10:26280
85-15655	NTIS, PC A05/MF A01				10:26423
NASA-CR-					
168195	*See* DOE/NASA-0006-2	E 1.99:	DE85009910	MN -96	10:25804
171199	*See* N-85-12318				10:25783
174071	*See* N-85-15599				10:26267
174197	*See* N-85-14777				10:26259
174204	*See* N-85-15596				10:26266
NASA-TM-					
85746	NTIS, PC A03/MF A01		TI85901298	MN -38	10:25907
86179	*See* N-85-15652				10:26280
87398	*See* N-85-15655				10:26423
NCEL-TN-					
1712	*See* AD-A-149617/3/XAB				10:25960
NEANDC(J)-					
113/ U	NTIS (US Sales Only), PC A03/MF A01; 1		DE85901374	MN -34C	10:26365

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NMERDI-				
2-71-4333	NTIS, PC A06/MF A01; 1 - NMERDI-Information Center, Univ. of New Mexico, 117 Richmond Dr., N.E., Albuquerque, NM 87106	DE85901363	MN -92a	10:25224
NP-				
4901601	NTIS (US Sales Only), PC A03/MF A01; 1	DE84901601	MN -95	10:25962
5750892	NTIS (US Sales Only), PC A06/MF A01; 1	DE85750892	MN -11	10:26077
5770196	NTIS (US Sales Only), PC A04/MF A01; 1	DE85770196	MN -13	10:25690
5770197	NTIS (US Sales Only), PC A02/MF A01	DE85770197	MN -63	10:25420
5770198	NTIS (US Sales Only), PC A02/MF A01	DE85770198	MN -95	10:25760
5770199	NTIS (US Sales Only), PC A02/MF A01	DE85770199	MN -95d	10:25761
5770200	NTIS (US Sales Only), PC A05/MF A01; 1	DE85770200	MN -59A	10:25477
5770202	NTIS (US Sales Only), PC A03/MF A01; 1	DE85770202	MN -13	10:25672
5770204	NTIS (US Sales Only), PC A05/MF A01	DE85770204	MN -88	10:25183
5770205	NTIS (US Sales Only), PC A04/MF A01; 1	DE85770205	MN -96	10:25784
5770206	NTIS (US Sales Only), PC A03/MF A01; 1	DE85770206	MN -96	10:25785
5770207	NTIS (US Sales Only), PC A11/MF A01; 1	DE85770207	MN -13	10:25683
5770208	NTIS (US Sales Only), PC A02/MF A01	DE85770208	MN -95d	10:25945
5770209	NTIS (US Sales Only), PC A08/MF A01	DE85770209	MN -38	10:25968
5770210	NTIS (US Sales Only), PC A09/MF A01; 1	DE85770210	MN -96	10:25786
5770211	NTIS (US Sales Only), PC A10/MF A01; 1	DE85770211	MN -96	10:25787
5770212	NTIS (US Sales Only), PC A04/MF A01; 1	DE85770212	MN -38	10:25511
5770213	NTIS (US Sales Only), PC A09/MF A01; 1	DE85770213	MN -90c	10:25130
5770214	NTIS (US Sales Only), PC A02/MF A01	DE85770214	MN -13	10:25669
5770215	NTIS (US Sales Only), PC A02/MF A01; 1	DE85770215	MN -13	10:25670
5770216	NTIS (US Sales Only), PC A02/MF A01; 1	DE85770216	MN -13	10:25671
5770217	NTIS (US Sales Only), PC A08/MF A01; 1	DE85770217	MN -48	10:26197
5770267	NTIS (US Sales Only), PC A03/MF A01	DE85770267	MN -13	10:25691
5770268	NTIS (US Sales Only), PC A04/MF A01; 1	DE85770268	MN -13	10:25712
5770269	NTIS (US Sales Only), PC A03; 3	DE85770269	MN -38	10:25512
5770270	NTIS (US Sales Only), PC A07/MF A01	DE85770270	MN -4	10:25386
5770271	NTIS (US Sales Only), PC A05/MF A01	DE85770271	MN -90a	10:25153
5770275	NTIS (US Sales Only), PC A03/MF A01; 1	DE85770275	MN -59B	10:25769
5770276	NTIS (US Sales Only), PC A07/MF A01; 1	DE85770276	MN -90d	10:25165
5770277	NTIS (US Sales Only), PC A07/MF A01	DE85770277	MN -92b	10:25236
5770278	NTIS (US Sales Only), PC A08/MF A01; 1	DE85770278	MN -61	10:25375
5770279	NTIS (US Sales Only), PC A08/MF A01; 1	DE85770279	MN -96	10:25765
5770280	NTIS (US Sales Only), PC A04/MF A01; 1	DE85770280	MN -11	10:25789
5770281	NTIS (US Sales Only), PC A12/MF A01; 1	DE85770281	MN -95	10:25770
5770282	NTIS (US Sales Only), PC A09/MF A01; 1	DE85770282	MN -11	10:26098
5770283	NTIS (US Sales Only), PC A07/MF A01	DE85770283	MN -48	10:26198
5900346	University of California, Scripps Institute of Oceanography - Deep Sea Drilling Project, A-031, La Jolla, CA 92093	TI85900346	MN -11	10:26256
5901364	New Mexico Bureau of Mines and Mineral Resources, Socorro, NM 87801	TI85901364	MN -92a	10:25259
5901391	City of New York, Dept. of Sanitation, Office of Resource Recovery, 51 Chambers St., Rm 815, New York, NY 10007	TI85901391	MN -95e	10:26126
5901392	City of New York, Dept. of Sanitation, Office of Resource Recovery, 51 Chambers St., Rm 815, New York, NY 10007	TI85901392	MN -95e	10:26127
5901395	City of New York, Dept. of Sanitation, 51 Chambers Street, Room 815, New York, NY 10007	TI85901395	MN -95e	10:26128
NRL-Memo-				
5560	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE85011384	MN -21	10:26508
NRL-MR-				
5324	*See* AD-A-149688/4/XAB			10:25932
5445	*See* AD-A-149686/8/XAB			10:25931
5493	*See* AD-A-150462/0/XAB			10:26009
5499	*See* AD-A-150059/4/XAB			10:25934
NUREG-				
0020-Vol.9-No.2	NTIS, PC A18/MF A01 - GPO	TI85901303	MN -80	10:25582
0090-Vol.7-No.3	NTIS, PC A04/MF A01 - GPO	TI85901410	MN -80	10:25630
0540-Vol.7-No.2	NTIS, PC A99/MF A01 - GPO	TI85901413	MN -2	10:25583
0540-Vol.7-No.3	NTIS, PC A19/MF A01 - GPO	TI85901414	MN -2	10:25584
0675-Suppl.28	NTIS, PC A99/MF A01 - GPO $11.00	TI85901407	MN -78	10:25631
0748-Vol.5-No.2	NTIS, PC A17/MF A01 - GPO	TI85901375	MN -78	10:25585
1125-Vol.1	NTIS, PC A99/MF A01 - GPO $11.00	TI85901431	MN -80	10:25632
1125-Vol.3	NTIS, PC A24/MF A01 - GPO $10.00	TI85901433	MN -80	10:25633
1125-Vol.4	NTIS, PC A99/MF A01 - GPO $11.00	TI85901434	MN -80	10:25634
1125-Vol.5	NTIS, PC A99/MF A01 - GPO $11.00	TI85901435	MN -80	10:25635
1125-Vol.6-App.	NTIS, PC A24/MF A01 - GPO $11.00	TI85901354	MN -80	10:25636
1131	NTIS, PC A02/MF A01 - GPO $3.00	TI85901388	MN -80	10:25637
NUREG/CR-				
1755-Add.1	NTIS (US Sales Only), PC A03/MF A01 - GPO $3.75	TI85007690	MN -78	10:25638
2000-Vol.4-No.3	NTIS, PC A04/MF A01 - GPO	TI85010555	MN -78	10:25639
3746-Vol.3	NTIS, PC A06/MF A01 - GPO $4.75	TI85010597	MN -78	10:25541
3757	NTIS, PC A05/MF A01	TI85010436	MN -79p	10:25640
3855	NTIS, PC A16/MF A01	TI85010463	MN -80	10:25641
3872	NTIS, PC A05/MF A01 - GPO	TI85007338	MN -80	10:25600
3885-Vol.3	NTIS, PC A03/MF A01 - GPO	TI85010137	MN -77	10:25642
3905-Vol.1-Rev.1	NTIS, PC A08/MF A01 - GPO $5.50	TI85010858	MN -78	10:25643

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3905-Vol.2	NTIS, PC A12/MF A01 - GPO $7.00		TI85010859	MN -78	10:25644
3905-Vol.3	NTIS, PC A17/MF A01 - GPO $8.50		TI85010860	MN -78	10:25645
3905-Vol.4	NTIS, PC A15/MF A01 - GPO $8.00		TI85010861	MN -78	10:25646
3950-Vol.1	NTIS, PC A06/MF A01 - GPO $5.00		TI85009145	MN -78	10:25542
3980-Vol.2	NTIS, PC A03/MF A01 - GPO		TI85008727	MN -78	10:25647
4004	NTIS, PC A03/MF A01 - GPO $4.00		TI85901361	MN -78	10:25569
4015	NTIS, PC A05/MF A01 - GPO		TI85010349	MN -78	10:25593
4033	NTIS, PC A05/MF A01 - GPO		TI85011276	MN -41	10:26183
4035	NTIS, PC A03/MF A01 - GPO $4.00		TI85010599	MN -71	10:25290
4051	NTIS, PC A05/MF A01 - GPO $4.50		TI85010458	MN -80	10:25530
4084	NTIS, PC A03/MF A01 - GPO		TI85010464	MN -78	10:25291
4101	NTIS, PC A99/MF A01 - GPO $11.00		TI85901372	MN -70B	10:25301
4124	NTIS, PC A03/MF A01 - GPO		TI85009973	MN -78	10:25648
4139	NTIS, PC A05/MF A01 - GPO $4.50		TI85011202	MN -80	10:25587
4155	NTIS, PC A03/MF A01 - GPO		TI85010598	MN -78	10:25649
4173	NTIS, PC A04/MF A01 - GPO $4.50		TI85901325	MN -78	10:25650
4181	NTIS, PC A06/MF A01 - GPO		TI85010918	MN -78	10:25302
4191	NTIS, PC A11/MF A01 - GPO $6.50		TI85011295	MN -80	10:25596
4212	NTIS, PC A12/MF A01 - GPO $6.50		TI85010862	MN -78	10:25570
4237	NTIS, PC A04/MF A01 - GPO $4.50		TI85901383	MN -70	10:25323
NYSERDA-					
85-1	New York State Energy Research and Development Authority, Two Rockefeller Plaza, Albany, NY 12223		TI85901397	MN -61A	10:25421
85-4	New York State Energy Research and Development Authority, Two Rockefeller Plaza, Albany, NY 12223		TI85901378	MN -61A	10:25394
OCS/MMS-					
84-0075	OCS Information Program, Office of Offshore Information Services, Minerals Management Service, 12203 Sunrise Valley Dr., MS 640, Reston, VA 22091		TI85901419	MN -92	10:25235
OEI-					
8304-1-Vol.1-Rev.0	*See* DOE/ID/12488-T1-Vol.1-Rev.0	E 1.99:	DE85011076	MN -78	10:25655
8304-1-Vol.2-Rev.0-Apps.	*See* DOE/ID/12488-T1-Vol.2-Rev.0-Apps.	E 1.99:	DE85011078	MN -78	10:25656
OH-					
82-103-K	NTIS (US Sales Only), PC A03/MF A01		DE85700599	MN -41	10:25598
82-311-K	NTIS (US Sales Only), PC A03/MF A01		DE85700600	MN -41	10:25599
ORNL-					
6120	NTIS, PC A13/MF A01; 1 (GPO Dep.)	E 1.99:	DE85006958	STD -34	10:26366
6128	NTIS, PC A13/MF A01 (GPO Dep.)	E 1.99:	DE85008766	MN -34	10:25792
6145	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85010593	MN -41	10:26434
ORNL/LMR/SP-					
85/ 3	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010621	MN -79	10:25586
ORNL/NSIC-					
200-Vol.4-No.3	*See* NUREG/CR-2000-Vol.4-No.3		TI85010555	MN -78	10:25639
223-Vol.1-Rev.1	*See* NUREG/CR-3905-Vol.1-Rev.1		TI85010858	MN -78	10:25643
223-Vol.2	*See* NUREG/CR-3905-Vol.2		TI85010859	MN -78	10:25644
223-Vol.3	*See* NUREG/CR-3905-Vol.3		TI85010860	MN -78	10:25645
223-Vol.4	*See* NUREG/CR-3905-Vol.4		TI85010861	MN -78	10:25646
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81-22201/ 3	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85010590	MN -59B	10:25762
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9253	*See* NUREG/CR-3872		TI85007338	MN -80	10:25600
9267/ V3	*See* NUREG/CR-3885-Vol.3		TI85010137	MN -77	10:25642
9390	*See* NUREG/CR-4015		TI85010349	MN -78	10:25593
9439	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85010261	STD -41	10:26046
9493	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85010274	STD -20	10:26509
9584	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85010591	STD -86	10:25287
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5211	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85009976	MN -34C	10:26008
OTA-M-					
224	*See* PB-85-156081/XAB				10:25720
OTA-O-					
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276	*See* PB-85-154219/XAB				10:26119
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5210-Vol.1	*See* NUREG/CR-3950-Vol.1		TI85009145	MN -78	10:25542
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5380	NTIS, PC A08/MF A01; 1 (GPO Dep.)	E 1.99:	DE85010540	MN -70	10:25370
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12995	NTIS, PC A05/MF A01 (GPO Dep.)	E 1.99:	DE85011348	MN -95d	10:25763
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08/ 82	NTIS (US Sales Only), PC A02/MF A01		DE85700610	MN -37	10:26014
18/ 82	NTIS (US Sales Only), PC A05/MF A01		DE85700581	MN -4	10:26129
21/ 82	NTIS (US Sales Only), PC A02/MF A01		DE85700604	MN -41	10:26435
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RFP-ENV-					
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372P	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85011392	MN -70	10:26228
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398P	*See* RHO-BW-SA-398AP	E 1.99:	DE85010543	MN -70	10:25309
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UA Ukrainian Soviet Socialist Republic (Ukrainian SSR)
UG Uganda
US United States of America (USA)
UY Uruguay

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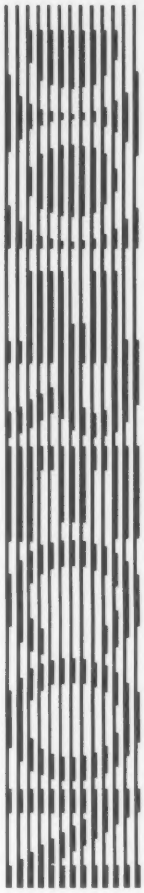
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